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A Trainee Demand Analysis for the Expansion of the Marine Corps Embassy Security Group

17 April 2013

Maj Richard T. Slack, USMC

Advisors: Don Summers and Simona Tick, Lecturers

Graduate School of Business and Public Policy

Naval Postgraduate School

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14. ABSTRACT

On September 11, 2012, the U.S. Consulate in Benghazi, Libya, was attacked, resulting in the death of four United States citizens, including Ambassador Christopher Stevens. Prior to Bengazi, the Marine Corps Embassy Security Group (MCESG) held a total strength of about 1,400 Marines, of which 1,196 were Marine Corps Security Guards (MSGs). In response to the deadly attack, Congress authorized 1,000 new MSGs through the 2013 National Defense Authorization Act, creating additional protection for U.S. diplomatic facilities worldwide. In this thesis I examine the growth requirements needed to support the MCESG?s expansion demands to produce MSGs at maximum capacity in the coming three to four years, and I propose an operational, easily adjustable methodology to assist MCESG operation personnel plans for expansion and future force sustainment. The methodology accounts for uncertainty in the decision-making process by incorporating Monte Carlo simulation techniques. I also provide in this thesis an easy to use interface built as a Visual Basic for Applications (VBA) UserForm, meant as a simple and effective tool that can assist planners in standardizing procedures at the operational level. The findings of the thesis indicate that the proposed methodology could yield significant savings in terms of manpower and training requirements for the MCESG.

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ABSTRACT

On September 11, 2012, the U.S. Consulate in Benghazi, Libya, was attacked, resulting in the death of four United States citizens, including Ambassador Christopher Stevens. Prior to Bengazi, the Marine Corps Embassy Security Group (MCESG) held a total strength of about 1,400 Marines, of which 1,196 were Marine Corps Security Guards (MSGs). In response to the deadly attack, Congress authorized 1,000 new MSGs through the 2013 National Defense Authorization Act, creating additional protection for U.S. diplomatic facilities worldwide. In this thesis I examine the growth requirements needed to support the MCESG's expansion demands to produce MSGs at maximum capacity in the coming three to four years, and I propose an operational, easily adjustable methodology to assist MCESG operation personnel plans for expansion and future force sustainment. The methodology accounts for uncertainty in the decision-making process by incorporating Monte Carlo simulation techniques. I also provide in this thesis an easy to use interface built as a Visual Basic for Applications (VBA) UserForm, meant as a simple and effective tool that can assist planners in standardizing procedures at the operational level. The findings of the thesis indicate that the proposed methodology could yield significant savings in terms of manpower and training requirements for the MCESG.

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GO GAMECOCKS!

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LIST OF ACRONYMS AND ABBREVIATIONS

ARB	Accountability Review Board
BIC	Billet Identification Code
CMC	Commandant of the Marine Corps
DC	Deputy Commandant
DetCo	Detachment Commander
DoD	Department of Defense
DoS	Department of State
DS	Diplomatic Security
DSS	Decision Support System
FY	Fiscal Year
GoS	Goods of Service
HQ	Headquarters
HQMC	Headquarters, Marine Corps
IA	Individual Augment
MCESG	Marine Corps Embassy Security Group
MOS	Military Occupational Specialty
MSG	Marine Security Guard
NJP	Non-Judicial Punishment
PCS	Permanent Change of Station
PP&O	Plans, Policy, and Organization
PY	Prior Year
RfC	Release for Cause
RPG	Rocket-Propelled Grenades
SAS	Security Augmentation Squads
SAU	Security Augmentation Unit
SMP	Special Mission Compound
SNCO	Staff Non-Commissioned Officer
T/O	Table of Organization
USMC	United States Marine Corps
VBA	Visual Basic Application
WS	Watchstander

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I. INTRODUCTION

A. OVERVIEW

On September 11, 2012, the U.S. Consulate in Benghazi, Libya, was attacked, resulting in the death of four United States citizens, including the U.S. Ambassador, Christopher Stevens. Prior to the attacks, in Benghazi the Marine Corps Embassy Security Group (MCESG) held a total strength of approximately 1,392 Marines, of which 1,196 were Marine Corps Security Guards (MSGs). In the aftermath of this attack, “Congress authorized growth of up to 1,000 Marines for embassy security” (Marine Corps Embassy Security Group [MCESG], 2013) The MCESG expansion will start late in fiscal year (FY) 2013 or early FY 2014 and last through FY 2016. During this time, 53 new Marine Security Guard detachments will be established, and 975 additional MSGs will be trained. Of the 975 new MSGs, 117 will form a new Security Augmentation Unit (SAU) designed to rapidly respond from the MCESG in Quantico, VA. The mission of the SAU will be to augment the physical security shortfalls at designated U.S. diplomatic facilities around the globe.

B. OBJECTIVE

The objective of this thesis is to examine the growth requirements needed to support the MSG expansion demands and to propose an operational and effective decision support methodology to assist MCESG operation personnel plan for expansion and future force sustainment. During this research, I found that MCESG plans to produce MSGs at maximum capacity in the next three to four years. In this study, I analyze the trainee demands required for the expansion of the MCESG and propose a methodology that can assist the MCESG operations personnel plan for the expansion and future force sustainment. The proposed methodology is founded on an Excel based analytical approach, which relies heavily on simulation and is easily interfaced through a Visual Basic for Applications (VBA) UserForm. The model itself can be easily manipulated as operational needs dictate the requirements for expansion or sustainment. Once developed, the VBA UserForm is a simple and effective tool that can assist planners in standardizing procedures at the operational level.

C. ORGANIZATION OF THESIS

In the chapters that follow, I present a review of the MSG's background, a literature review, the data and assumptions used in the thesis, a methodology, and the analysis and findings from the applied methodology. This thesis ends with conclusions that provide a brief overview of the trainee demand findings and with recommendations for future research and implementation.

D. PROBLEM STATEMENT

Following the Benghazi attacks and Congress' authorization for the United States Marine Corps (USMC) to expand the MSG community by nearly half, the Department of State (DoS) and the MCESG have established the growth demands for the MSG expansion. Current research indicates that the MCESG plans on conducting MSG training at maximum capacity to meet these demands. The problem with a maximum capacity production plan is the *potential* for an excess supply of MSGs produced in the coming years. This could in turn have an impact on other USMC communities in the current force reduction.

E. RESEARCH QUESTION

What trainee demands are required to meet the demands for the MSG expansion authorized by Congress?

F. METHODOLOGY

I conducted the analysis for this thesis in three parts. First, I describe the model, then I describe how I simulated the model, and finally, I introduce Visual Basic for Applications (VBA). The development of this methodology was inspired mainly by an Australian Department of Defence study I came across in my research titled *Determining Training Demands for an Expanding Military Organisation.* The work in the Australian study disclosed techniques that helped build a foundation for the mathematical concepts and VBA UserForm described in the following chapters.

II. BACKGROUND

A. OVERVIEW

For almost 70 years, the USMC and the DoS have partnered to provide the global protection of classified U.S. information and diplomatic personnel with MSGs. The official USMC (n.d.-a.) website expounds on the origins of MSGs and the critical role they play in creating a safe environment for U.S. diplomatic posts around the world.

> The origins of the modern MSG Program began with the Foreign Service Act of 1946, which stated that the Secretary of Navy is authorized, upon the request of the Secretary of State, to assign enlisted Marines to serve as custodians under the supervision of the senior diplomatic officer at an embassy, legation, or consulate. Using this act, the DoS and U.S. Marine Corps entered into negotiations to establish the governing provisions for assigning MSGs overseas. These negotiations culminated in the first joint memorandum of agreement, signed on December 15, 1948.

Since 1948, the MSG program has grown to over 1,000 Marines and 150 detachments worldwide. Each detachment is staffed with Marines that are designated with the Military Occupational Specialty (MOS) code 8156. The code is divided into two categories: detachment commanders (DetCos) and watchstanders (WSs). DetCos are sourced from staff non-commissioned officers (SNCOs) with either a rank of staff sergeant (E-6), gunnery sergeant (E-7), or master sergeant (E-8). The DetCos are assigned WSs from either the rank/grade of private first class (E-2), lance corporal (E-3), corporal (E-4), or sergeant (E-5).

The DoS assigns classified regional threat levels predicating the decision to staff MSGs at diplomatic facilities abroad. The regular size of an MSG detachment consists of one detachment commander and five WSs. Dependent on the threat level, a larger detachment may be posted at the mission. Larger MSG detachments are organized with two DetCos and 25 WSs. Subsequently, if the threat level is classified below a certain threshold, detachments may not be assigned to U.S. embassies or consulates. Table 1 shows the detachment size based on threat levels.

Table 1. MSG Detachment Size

Detachment Size	1/5	2/25
Threat level	Normal	High
Detachment Commanders	1	2
Watchstanders	5	25

Congress' call to expand the MSG program after the recent deadly consulate attacks will almost double its footprint. In a period of increased global security threats, this expansion is necessary to sustain the MSG mission. The following quote from the USMC (n.d.-b.) website explains the mission of the MSG:

> The primary mission of the Marine Security Guard (MSG) is to provide internal security at designated U.S. diplomatic and consular facilities in order to prevent the compromise of classified material vital to the national security of the United States. The secondary mission of the MSG is to provide protection for U.S. citizens and U.S government property located within designated U.S. diplomatic and consular premises during exigent circumstances (urgent temporary circumstances which require immediate aid or action).

MCESG Headquarters (HQ), commanded by a Marine colonel, has added a new compound aboard Marine Corps Base Quantico in northern Virginia. In close proximity to the FBI Training Academy and Laboratory, the compound is opening in three phases with barracks, training facilities, and administrative buildings with a small-scale mock replica of a U.S. embassy. Construction should be complete in 2014. The MCESG commanding officer "is responsible to the deputy commandant (DC), Plans, Policies, and Operations (PP&O), Headquarters, U.S. Marine Corps [HQMC]" (USMC, n.d.-a). Among the duties of the colonel is the recruitment and training of new trainees. The following quote from the USMC (n.d.-b.) website explains in detail the responsibilities of the MCESG's commanding officer:

> The commanding officer of the MCESG reports to the Commandant of the Marine Corps (CMC), exercising command, less operational supervision, of Marines assigned to MSG detachments. MCESG Headquarters is responsible for the screening, training, assignment, administration, logistical support of Marine Corps–unique items, and discipline of Marines assigned to the MCESG. The commanding officer, MCESG, also commands those Marines assigned to Headquarters, MCESG, and MCESG regional headquarters, and is the director, MSG School. MSG

> School provides suitability screening and formal training for selected Marines to perform duties as MSGs at Foreign Service missions.

The MCESG organization is composed of nine regional HQs, each commanded by a Marine lieutenant colonel.

> MCESG Region Commands report to the commanding officer of the MCESG and exercise command, less operational supervision, of Marines assigned to the MSG detachments in their respective regions. The MCESG Region Headquarters ensure the continued training, operational readiness, personnel administration, and logistical support, as well as the morale, welfare, and discipline of Marines assigned for duty to MSG detachments at designated U.S. diplomatic missions in order to support the Department of State in the protection of classified material at foreign posts. (USMC, n.d.-b)

As of February 2013, there are 152 active MSG detachments located in nine regions. Table 2 presents the nine active MCESG regional commands and the number of detachments they command.

Table 2. Regional HQs of the MCESG (February 2013)

Region	Headquarters Location	Area of Responsibility	Detachments
1	Frankfurt, Germany	Eastern Europe and Eurasia	17
2	Abu Dhabi, United Arab Emirates	India and Middle East	18
3	Bangkok, Thailand	East Asia and Pacific	18
4	Fort Lauderdale, Florida	South America	13
5	Frankfurt, Germany	Western Europe and Scandinavia	18
6	Pretoria, South Africa	East Africa	18
7	Frankfurt, Germany	North Africa and West Africa	18
8	Frankfurt, Germany	Central Europe	18
9	Fort Lauderdale, Florida	North America and Caribbean	14

The current manning of the MSG program, as of the 2nd quarter of FY 2013, has an end strength of 1,392 Marines. The organizational structure includes the following:

1. MCESG HQ is staffed by 127 Marines, which includes 14 Marines with the 8156 MOS. The 8156 MOS is a designation for Marines who have graduated from the MCESG's MSG training program for the purpose of serving at U.S. embassies and consulates.

2. Nine regional HQs currently manned with 83 non-MSG Marines.

3. There are 154 detachments (including two inactive) being supported by 1,196 MSGs. This breaks down into 156 detachment commanders (E-6, E-7, & E-8 ranks) and 1,026 watchstanders (WSs; E-2, E-3, E-4, & E-5 ranks).

Figure 1 displays the locations of the 152 MSG detachments established in 37 countries and nine regions.

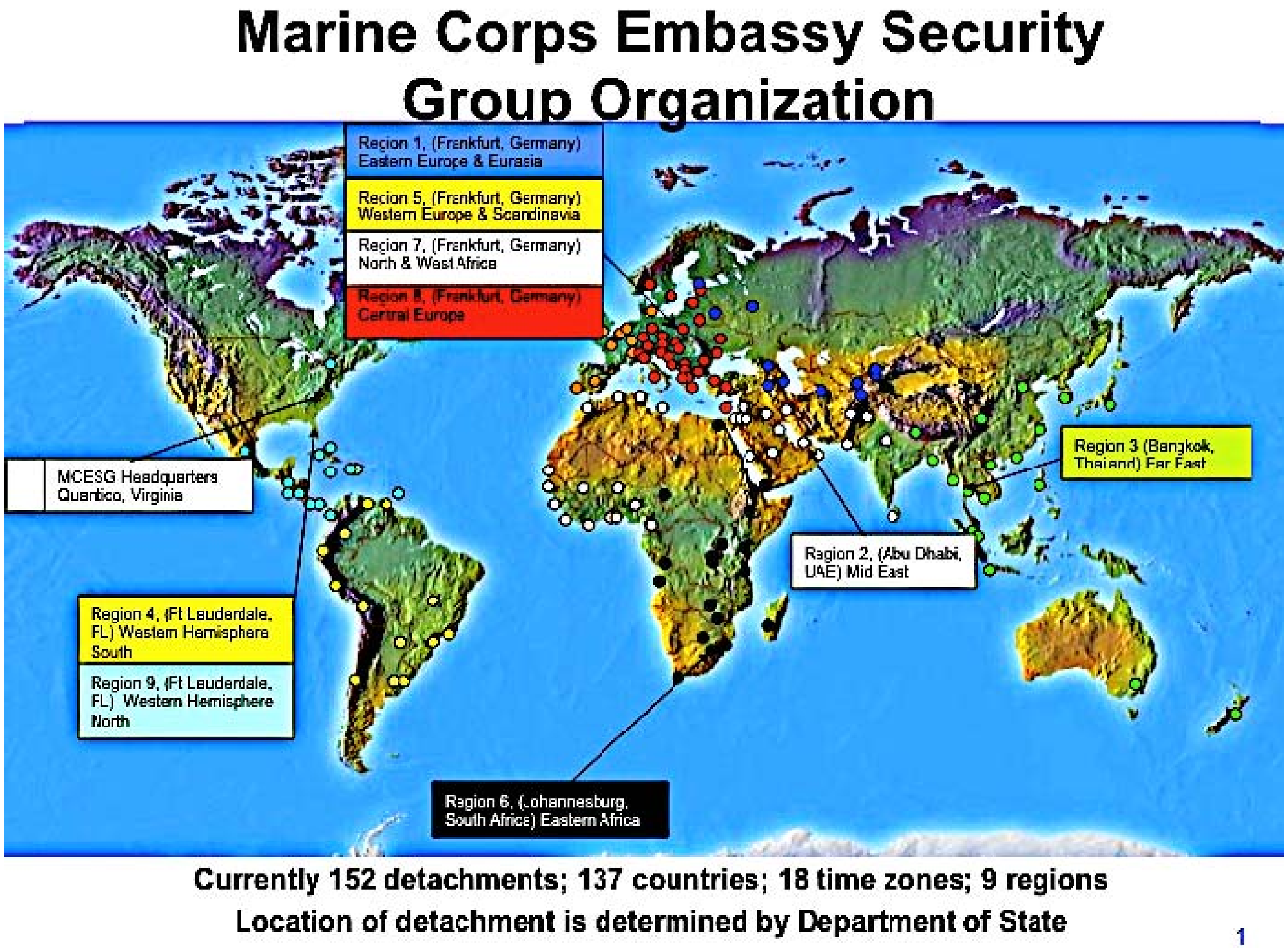

Figure 1. Map of MCESG Organization
(MCESG, 2013)

B. POLICY CHANGE

The government revisited the value added to security by the presence of MSG detachments abroad after a U.S. consulate, without MSGs, was targeted and destroyed by terrorists. The following quote explains the attacks in more detail:

> A series of terrorist attacks in Benghazi, Libya, on September 11–12, 2012, involving arson, small-arms and machine-gun fire, and use of rocket-propelled grenades (RPGs), grenades and mortars, focused on two U.S. facilities in Benghazi, as well as U.S. personnel en route between the two facilities. In addition, the attacks severely wounded two U.S. personnel, injured three Libyan contract guards and resulted in the destruction and abandonment of both facilities—the U.S. Special Mission compound (SMC) and Annex. (Department of State [DoS], 2013, p. 1)

The Benghazi attacks proved to be the catalyst for a policy change, which led to Congress authorizing an increase in the size of the MSG program over the next few years. This increase in strength will be vital to improving the stability and security of diplomatic missions overseas. After the attack, the DoS (2013) convened an Accountability Review Board (ARB) whose report stated that

> the Benghazi attacks took place against a backdrop of significantly increased demands on U.S. diplomats to be present in the world's most dangerous places in order to advance American interests and connect with populations beyond capitals, and beyond the host governments' reach. (p. 2)

Upon review, "key recommendations were made in the following six areas: overarching security considerations; staffing high risk, high threat posts; training and awareness; security and fire safety equipment; intelligence and threat analysis; and personnel accountability" (DoS, 2013, p. 7). The focus of this thesis is on key recommendation 11, found under the overarching security considerations, which states the following:

> 11. The Board supports the State Department's initiative to request additional Marines and expand the Marine Security Guard (MSG) Program as well as corresponding requirements for staffing and funding. The Board also recommends that the State Department and DoD [Department of Defense] identify additional flexible MSG structures and request further resources for the Department and DoD to provide more capabilities and capacities at higher risk posts. (DoS, 2013, p. 10)

The DoS has requested Congress to redirect about $1.4 billion in appropriated funding for operations in Iraq towards these new ARB recommendations. Over $550 million of this amount has been slated for the Marine Security Guard expansion.

C. MARINE CORPS EMBASSY GROUP EXPANSION

In the aftermath of the Benghazi attacks, "Congress authorized growth of up to 1,000 Marines for embassy security" (MCESG, 2013). The USMC's expansion planning has been completed and has identified FY 2016 target growth and end strength requirements. The expansion plan for the MCESG will create 53 new detachments and 975 new MSG billet identification codes (BICs). It was discovered that the MCESG plans on conducting MSG production at maximum capacity to meet the growth demands. If the MSG training demand exceeds the organizational demands required, an excess supply of trained MSGs could emerge. It is the purpose of this thesis to analyze the train demand through a model that can be applied to the organizational demands of the MCESG.

D. SUMMARY

The purpose of this chapter is to give the reader the requisite knowledge to understand the convergence of the MCESG mission and relevant current events leading up to policy change, which forms the basis for the research in this thesis. In Chapter III, I review the literature that I discovered in the course of this research.

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III. LITERATURE REVIEW

A. OVERVIEW

The purpose of this literature review is to seek out the methods and techniques available for application to an organized approach in determining training demands.

B. TRAINING DEMANDS

Study by Wang, Vozzo, and Galanis (2005)

In a 2005 study, Jun Wang, Armando Vozzo, and George Galanis of the Australian Defence Science and Technology Organisation analyzed the calculation of training demand for an expanding military force. The study was aptly named *Calculating the Training Demand in an Expanding Military Organisation: An Analytical Solution*. Wang, Vozzo, and Galanis (2005) study outlined two analytical methods calculating the instructor training demands in an expanding military force. The impetus for this work was a "circular reference" error discovered in the spreadsheet formulas used to calculate the training demands in expanding organizations. The authors addressed training demands in two parts: steady state demand and expansion demand. Expansion demand is further addressed in two aspects: the *suck-up* training effect and the dynamic training effect. The suck-up effect causes shortages during periods of expansion when lower ranks are sourced to fill the increased number of higher ranks. Wang, Vozzo, and Galanis (2005) also observed that during expansion, an increased demand for instructors from combat units reduces the combat force while increasing the training demand. This increased demand is presented as the *dynamic* training effect.

Wang, Vozzo, and Galanis (2005) concluded that the dynamic training effect is the result of one of many training policies and may not be the optimal solution. They recommended further research to determine the training demands for their organization.

This study presents iterative and recursive views for addressing the instructor expansion problem. Although in this thesis I do not address instructor-staffing concerns, the logic presented in the Wang, Vozzo, and Galanis (2005) study helps formulate a foundation for identifying the training demands in Chapter IV.

Study by Yan, Chen, and Chen (2007)

This 2007 study by Shangyao Yan of Taiwan's National Central University, Chia-Hung Chen of Taiwan's Shu-Te University, and Miawjane Chen of Taiwan's National United University was conducted under the sponsorship of the National Science Council of Taiwan. The study developed "two stochastic models used for air cargo terminal manpower supply planning in long-term operations. These two long-term stochastic-demand planning models accounted for stochastic disturbances, which are usually representative of actual demand forecasts" (Yan et al., 2007, p. 1). Yan et al. (2007) based their stochastic models on two deterministic models, which were designed for long-term demand planning. It is the premise of Yan et al. that stochastic models are better planning tools due to the reflection of actual manpower demand fluctuations. In the following passage by Yan et al. (2007), random models are considered better than certain models when considering demand:

> A planned terminal manpower supply plan is the basis for the real future operations. Real operations must fulfill the planning objectives by implementing the planned terminal manpower supply plan. Thus, the inter-relationship between the planned terminal manpower supply plan and the real operations must be kept in mind when dealing with real problems with stochastic manpower demands. When these real stochastic manpower demands are not considered, then deterministic demand models, based on the average (or projected) demand, will tend to use resources too tightly, resulting in an overly optimistic "optimal" terminal manpower supply plan. (Yan et al., 2007, p. 1)

The analysis and results of this study led the researchers to conclude that their premise was in fact true: Stochastic models were superior to deterministic models by 0.32%, on average. The stochastic-demand models are efficient for both terminal manpower supply planning and shift setting in long-term operations (Yan et al., 2007, p. 274).

Although the MCESG's growth demands are deterministic, overall FY training demands remain stochastic. The methods presented in this study provide a reference for the development of long-term planning operations.

Study by Wang, Egudo, and Galanis (2007)

In this 2007 study, *Determining Training Demand for an Expanding Military Organisation*, Jun Wang, Richard Egudo, and George Galanis of the Australian Defence

Science and Technology Organisation analyzed the "disadvantages of a training plan whereby instructors don't return to the combat force after the expansion training period" (Wang, Egudo, & Galanis, 2007). Wang, Egudo, and Galanis (2007) conducted their study under the sponsorship of the Land Operations Division of the Defence Science and Technology Organisation. This main focus of Wang, Egudo, and Galanis's (2007) study was to analyze the effects of surplus instructors on training demands once an expansion period of training has been completed. Surplus instructors create gaps, which need to be filled in the operating forces because these surplus instructors are at the training command. Wang, Egudo, and Galanis (2007) conducted an analysis of two plans: the "pay-back-instructor" plan and the "instructor-returning" plan. In this study, Wang, Egudo, and Galanis (2007) used two separate applications to determine training demand; one of these applications was an Excel-based analytical tool, and the other was a mixed-integer optimization model.

After analyzing the results, the authors concluded that the instructor-returning plan has greater returns than the pay-back-instructor plan. They determined that the instructor-returning plan reduced the training demand and reduced the cost of the workforce (Wang, Egudo, & Galanis, 2007).

Although I do not address instructors in this thesis, Wang, Egudo, and Galanis's (2007) study presents an analytical approach, which provides insight for the planning and development of training demands through the framework of an analytical spreadsheet.

C. SUMMARY

In this chapter, I reviewed available literature about analytical approaches addressing training demands. In Chapter IV, I detail the data procured for use in the methodology and analytical approach.

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IV. METHODOLOGY

A. OVERVIEW

In this thesis I examine trainee demands required to support the expansion of the MCESG after the Benghazi attacks. During my research, I found that the current plan for expansion includes producing MSGs at maximum capacity. While the need and urgency to supply these MSGs to the nine regions is understandable, a maximum production plan could produce excess MSGs during a time of tight fiscal constraints.

The MCESG will, as always, provide the required number of MSGs to U.S. embassies and consulates. However, it is the premise of this thesis that a more precise production plan can be administered to fulfill the deterministic MSG growth demands for diplomatic posts. This thesis uses a methodology based on an analytic approach simulation and presented through the use of VBA. The techniques presented in this chapter may help planners in standardizing and formalizing procedures for determining trainee demands. The methodology used in this thesis is described in the following section.

B. MODEL SIMULATIONS

1. Background

Military organizations have used different forms of simulation for thousands of years, but it was not until mid-20th century that its use became common in business and industry. Today, much more advanced simulation techniques are used in the military and business thanks to the advent of the modern computer. The goal of simulation is "to try to duplicate the features, appearance, and characteristics of a real system" (Nagraj, Barry, & Stair, 2007). Simulations imitate real-world systems mathematically in order to assist solving real-world problems and shaping the decision-making process.

According to Nagraj et al. (2007), there are seven steps to the process of simulation. Figure 2 depicts the process of simulation.

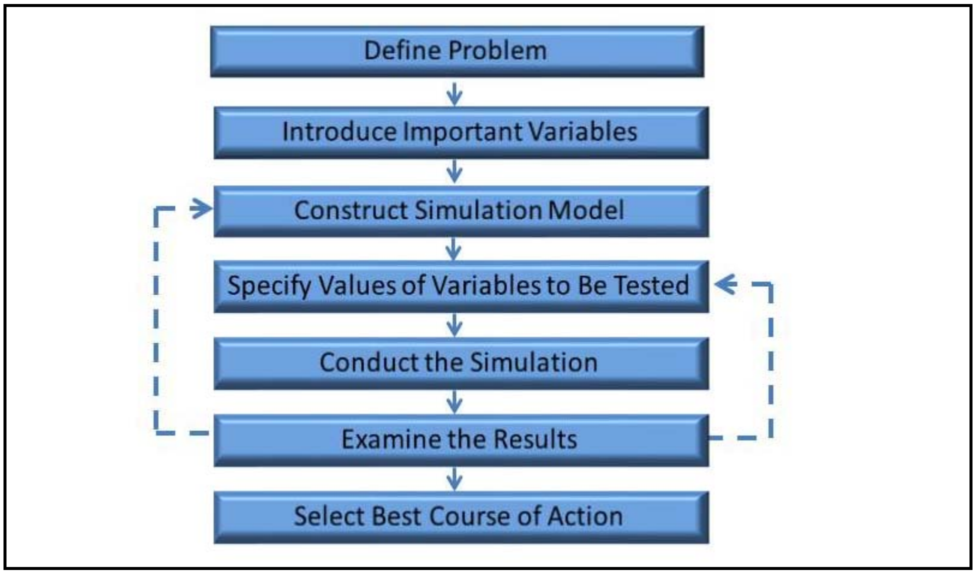

Figure 2. Process of Simulation
(Nagraj et al., 2007)

Due to many of its advantages, simulation has been used extensively in industry as a modeling technique since circa the mid-20th century. The advantages of simulation are as follows:

1. Simulation is relatively straightforward and flexible.
2. Simulation can be used to analyze large and complex real-world situations that cannot be solved by using conventional decision models.
3. Simulation allows what-if types of questions.
4. Simulation does not interfere with the real-world system.
5. Simulation allows researchers to study the interactive effects of individual components or variables to determine which ones are important.
6. Simulation makes “time compression” possible.
7. Simulation allows for the inclusion of real-world complications that most decision models cannot permit. (Nagraj et al., 2007)

The advantages of simulation make it an attractive technique; however, the user should also be aware of the disadvantages such as the following:

1. Good simulation models can be very expensive.
2. Simulation does not generate optimal solutions to problems.
3. Managers must generate all the conditions and constraints for solutions that they want to examine.
4. Each simulation model is unique. (Nagraj et al., 2007)

A relatively modern simulation technique is the Monte Carlo simulation. It was developed during World War II to solve complex problems, which were too cumbersome

to calculate manually. Specifically, Monte Carlo simulation was created to deal with the unpredictable nature of the neutrons being tested for nuclear weapons. Thus, the Monte Carlo simulation technique has become a valuable tool for dealing with problems of chance, randomness, and probability. Probabilistic problems are encountered every day in business operations and decision-making. Some examples of these random-natured problems that simulation can address are as follows:

- product demand,
- lead time for orders to arrive,
- time between machine breakdowns,
- time between arrivals as a service facility,
- service time,
- time to complete a project activity,
- number of employees absent from work on a given day, and
- stock market performance. (Nagraj et al., 2007)

Above, Nagraj et al. (2007) indicated that the number one advantage of using Monte Carlo simulations is the flexibility and ease with which they can be run. This is captured in the following three steps:

1. Establish a probability distribution for each variable in the model that is subject to chance.
2. Using random numbers, simulate values from the probability distribution for each variable in the first step.
3. Repeat the process for a series of replications (also called runs, or trials). (Nagraj et al., 2007)

As mentioned previously, the Monte Carlo simulation technique was developed to handle complex problems of chance, which are too difficult to calculate by hand. Because of these qualities, computers are a natural tool that is used to conduct simulation. There are several categories of software packages that can be used for simulation, such as general-purpose programming languages and special-purpose simulation languages. General-purpose programming languages, such as Visual Basic or C++, offer the seasoned programmer a diverse range of options for developing simulations. Special-purpose simulation languages, such as Visual SLAM or GPSS/H, have more advantages over the general-purpose programming languages, but they require even more skill and programmer experience. For the novice or non-programmers who require a simulation capability, Microsoft's Excel software is the easiest program to build, generate random numbers, and run simple simulations. It is because of the "built-in ability to generate

random numbers and use them to select values from several probability distributions makes spreadsheets excellent tools for conducting simple simulations. Spreadsheets are also very powerful for quickly tabulating results and presenting them using graphs" (Nagraj et al., 2007).

In this section, I discuss generating random numbers using Excel's more common features and probability distributions. Excel has a built-in random number generator feature, which is very simple to use. It requires activation of the Analysis Toolpak add-in, which provides the data analysis tools needed for statistical analysis. Among the analytical tools available, there is a random number generation feature that offers seven distributions. These seven distributions are uniform, normal, Bernoulli, binomial, Poisson, patterned, and discrete and are defined as follows:

- **Uniform:** Every random number has an equal chance of being selected. The user specifies the upper and lower limits.
- **Normal:** The random numbers correspond to a normal distribution. The user specifies the mean and standard deviation of the distribution.
- **Bernoulli:** The random numbers are either 0 or 1, determined by the probability of success that the user specifies.
- **Binomial:** This option returns random numbers based on a Bernoulli distribution over a specific number of trials, given a probability of success that the user specifies.
- **Poisson:** This option generates values in a Poisson distribution. A Poisson distribution is characterized by discrete events that occur in an interval, where the probability of a single occurrence is proportional to the size of the interval.
- **Patterned:** This option doesn't generate random numbers. Rather, it repeats a series of numbers in steps that the user specifies.
- **Discrete:** This option enables the user to specify the probability that specific values are chosen. It requires a two-column input range: the first column holds the values, and the second column must equal 100%. (Walkenbach, 2010)

Equations can also be manually entered in workbook cells to replicate the same features. The basic format for generating random numbers is: $=RAND()$. When this format has been successfully entered into a cell, the formula generates a random number between 0 and 99 every time the keyboard F9 button is toggled.

The more common distributions used are the uniform, discrete, and normal probability distributions. They are formatted as follows in Excel:

Continuous uniform distribution $= a + (b - a) * RAND()$

Discrete uniform distribution $= INT(a + (b - a + 1) * RAND())$

Normal distribution $= NORMINV(RAND(), \mu, \sigma)$

Normal distribution with integers
$= ROUND(NORMINV(RAND(), \mu, \sigma), 0)$
$= ROUND(NORMINV(RAND(), \mu, \sigma), 0)$

C. VISUAL BASIC FOR APPLICATIONS (VBA)

VBA is Microsoft Excel's programming language, which is used to develop applications based on business models, often in the form of Excel spreadsheets. In the book *VBA for Modelers*, Christian Albright (2012) stated that the "application will take this information, build the appropriate model, optimize if necessary, and eventually present the back end to the user—a nontechnical report of the results, possibly with accompanying charts." Applications can do this by using Excel spreadsheet models and transforming them into decision support systems (DSSs). DSSs "vary from very simple to very complex, but they usually provide some type of user-friendly interface so that a manager can experiment with various inputs or decision variables to see their effect on important output variables such as profit or cost" (Albright, 2012). To assist developers, Albright presented 10 guidelines for the development of readable and maintainable programs. They are as follows:

- Decide clearly what you want the application to accomplish.
- Communicate clearly to the user what the application does and how it works.
- Provide plenty of comments.
- Use meaningful names for variables, subs, and other programming elements.
- Use a modular approach with multiple short subs instead of one long one.
- Borrow from other programs that you or others have developed.
- Decide how to obtain the required input data.
- Decide what can be done at design time rather than at run time.
- Decide how to report the results.
- Add appropriate finishing touches. (Albright, 2012)

In Appendix D, there are examples of both DetCo and WS VBA UserForms for the model used in this thesis.

D. SUMMARY

Simulation is a straightforward and flexible technique that can gives the user a method to replicate real-world problems relative ease. The ability to conduct what-if type scenarios can increase the situational awareness of planners in developing courses of action in response to these scenarios. Although the MCESG has always met and will continue to meet the needs of U.S. diplomatic facilities, simulation can assist operations personnel in determine training demands with more efficiency and confidence. I conduct and discuss simulations and results analysis in the next chapter.

V. DATA AND ASSUMPTIONS

A. OVERVIEW

In this chapter, I describe the data and assumptions used in the analysis. The data for this thesis were sourced from the DoS and the MCESG. The administrative data that were collected encompass all current and projected growth numbers required to sustain the expansion of the MCESG Program. This data was used to analyze the training demands for the FY production of DetCo and WS MSGs.

The numbers in Table 3 are the growth targets for MCESG and indicate an annual growth of 4%, 10%, 8%, and 8%; and 15%, 15%, 18%, and 13%, respectively, for the DetCo and WS population. Table 3 presents the expansion goals for the DetCo and WS MSG communities.

Table 3. MCESG Expansion Growth Targets

FY Growth	FY 13	FY 14	FY 15	FY 16	FY 17
Detachment commander	7	17	15	15	0
Watchstander	159	173	251	205	0

B. MCESG EXPANSION DATA

In the aftermath of the Benghazi attack, "Congress authorized growth of up to 1,000 Marines for embassy security" (MCESG, 2013, slide 2). This expansion of the MSG program has been developed in a four-phase approach. This authorized increase (expansion) was intended to accomplish the following four goals:

- open additional detachments identified and prioritized by Diplomatic Security (DS);
- increase tables of organization (T/Os) of existing detachments (the threat at each location dictates the number for each);
- create an MSG security augmentation unit in Quantico; and
- provide adequate administration and support to the increased operational structure (MCESG, 2013, slide 5).

1. Current Manning. Of the current total 1,392 Marines in the MCESG, it is the 8156 MOS (MSGs) comprised of DetCo and the WS that have been gapped in previous years. This gap is a result of the DoS and MCESG adjusting the official HQMC T/O for operations prior to the Benghazi, Libya, attack of September 11, 2012. This gap

reflects a shortfall of 263 MSGs. The current end strength for the 8156 MOS is 1,196 MSGs, which includes 14 MSGs posted in individual augment (IA) BICs at the MCESG HQs in Quantico, VA.

2. **HQMC Approved T/O.** The HQMC T/O end strength identifies a 1,655 Marine requirement to support the MCESG. This manning number reflects the increase of 263 MSGs to cover existing personnel gaps. DetCos comprise 10 of these gaps and WSs comprise 253 gaps. Once these gaps have been filled, the increase will bring the DetCos' end strength from 156 to 166 and raise the WSs' end strength from 1,026 to 1,279 MSGs. Under the existing HQMC T/O, the total number of detachments, regional HQ personnel, and MCESG HQ personnel remains unchanged.

3. **Expansion T/O.** The expansion plan calls for end strength of 2,432 Marines. The additional 712 MSGs breakdown into 16 new IA BICs at MCESG HQ, 45 new DetCo BICs, 534 new WS BICs, and 117 new SAU BICs.

The MSG program expansion plan will increase MSG end strength from 1,459 MSGs to 2,171 MSGs, raising the total MSG organizational manning levels from 1,655 to a target goal of 2,432 Marines. This increase reflects an overall growth of 777 Marines, 712 of which are the growth target for MSGs. The 712 MSG growths will be decomposed into 45 new DetCos and 534 new WSs.

4. **Security Augmentation Unit.** Following the Benghazi attacks, an intelligence assessment called for the capability to respond to emergency needs of U.S. embassies and consulates, which has led to the formation of the SAU. The mission of the SAU is described in the following quote from the MCESG (2013):

> [The] primary mission: augment MSG detachments during periods of increased indications and warnings of an impending threat in the protection of U.S. citizens and property within U.S. diplomatic and consular premises. Be prepared to temporarily provide internal security at overseas U.S. diplomatic facilities that do not have MSG detachments. (slide 8)

The SAU T/O consists of a total of 122 Marines. There will be 117 MSGs, consisting of "nine detachment commanders and 108 watchstanders organized in nine security augmentation squads (SAS)" (MCESG, 2013, slide 12). Additionally, there will

be five Marines, including one officer and four enlisted Marines, providing supervision and support.

5. Additional Detachments. After an evaluation of the current level of 154 detachments (two inactive), "the Dept of State (DoS) identified 50 locations where Dets are needed" (MCESG, 2013, slide 2). The MCESG planning documents actually identify 53 new detachments, bringing the total number of detachments to 207. Of the 53 new detachments, only 38 have been identified as of this writing.

6. Support Personnel. The expansion plan calls for 65 new support personnel, including 38 new MCESG HQs Marines, 22 new regional HQs Marines, and five new SAU Marines. These 65 new support personnel bring the 712 new MSGs to a combined growth of 777 Marines for the MCESG organization. Figure 2 portrays the expansion goals of the MCESG.

Figure 3 succinctly presents the aforementioned data about the MCESG's current manning, the official USMC T/O, and the desired end strength for the expansion T/O.

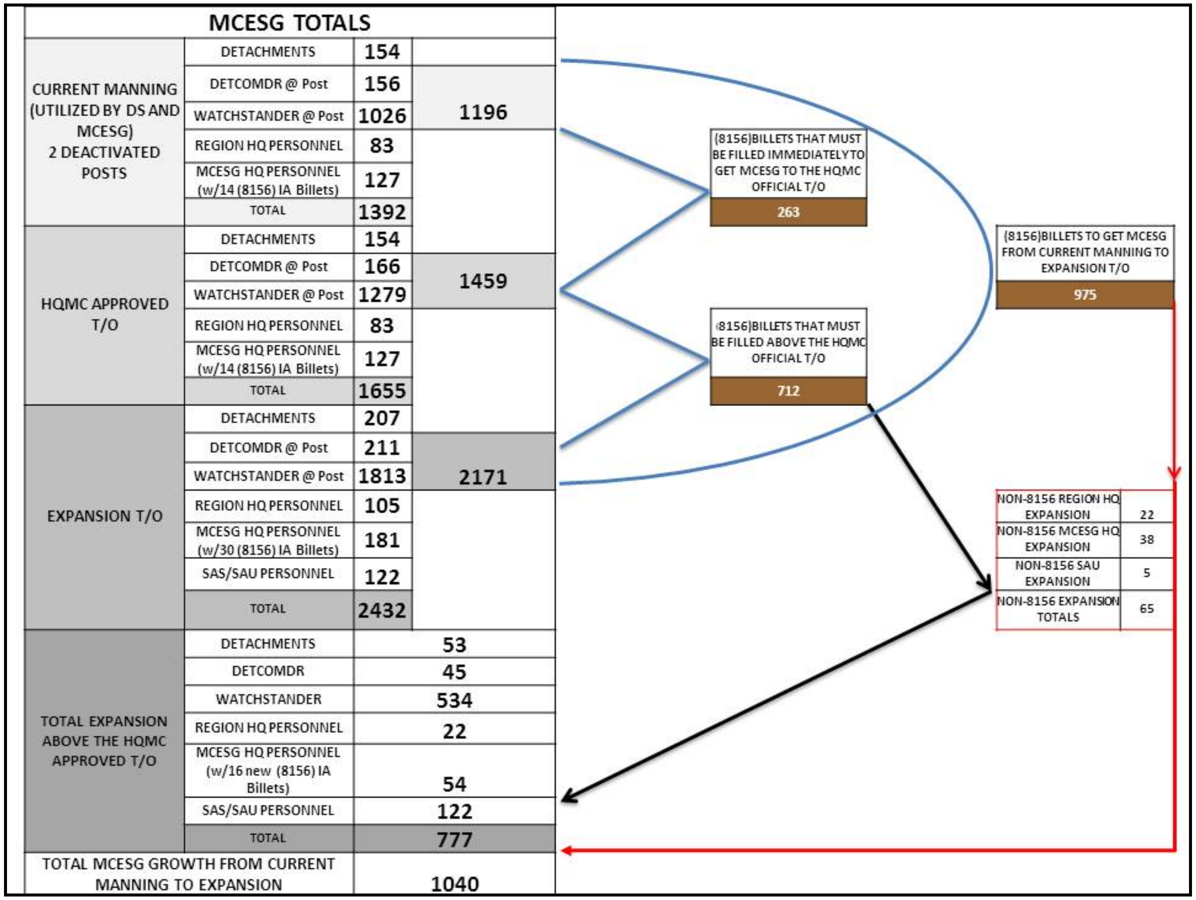

Figure 3. MCESG Expansion Plan
(MCESG, 2013)

C. MARINE SECURITY GUARD LIFE CYCLE

Upon graduation, the new MSGs are typically assigned to tour of duty of three years, rotating their assignments annually during the tour. During this three-year period, unforeseen events can prematurely shorten a tour of duty for some MSGs. These MSGs fall into two categories: goods of service (GoS) and Release for Cause (RfC). MSGs departing a tour of duty early in the GoS category leave because of circumstances outside their control, such as health issues. MSGs departing a tour of duty early in the RfC category leave for reasons such as non-judicial punishment (NJP). The sum of dropped MSGs categorized, like GoS and RfC, annually equates to the total MSG program drops for a given FY. I use the total program drops to determine the loss rate based on the average MSG strength during a given FY. Marines who complete a successful three-year tour of duty execute a PCS transfer out of MSG duty for their next USMC assignment

Figure 4 depicts the MSG life cycle.

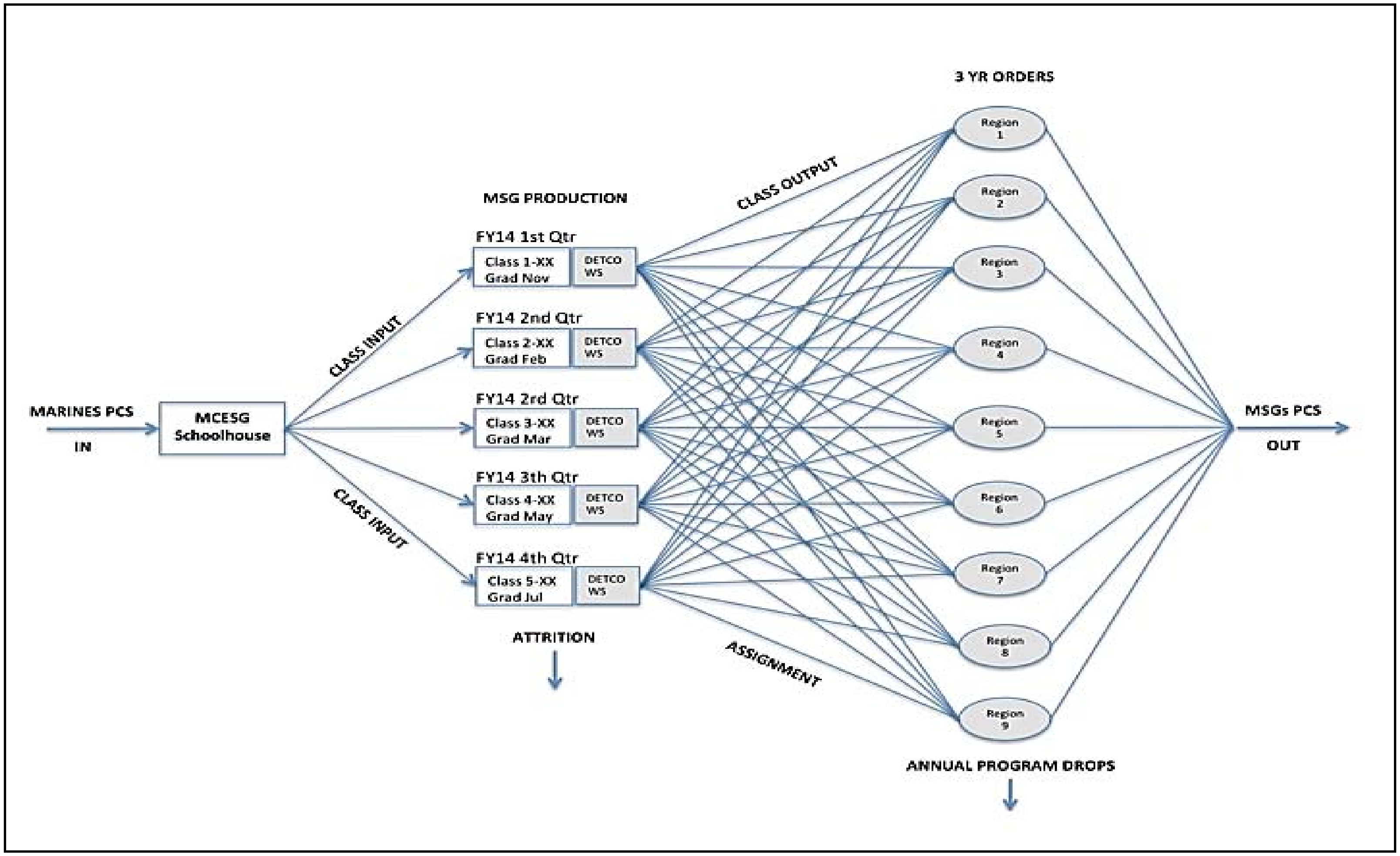

Figure 4. Marine Security Guard Life Cycle Process

D. MARINE SECURITY GUARD CLASS DATA

The actual class data from FY 2006 until the second quarter of 2013 are located in Appendix A. This data was used to establish averages and probability distribution that is discussed further in Section D of Chapter VI.

E. MARINE SECURITY GUARD PRODUCTION CAPACITY

The MCESG convenes five MSG classes annually in Quantico, VA. Each class is constrained by lodging and class size to a maximum capacity of 240 students. The maximum capacity for DetCo students is 25 students per class or 125 students per year. The maximum capacity for WS students is 215 students per class or 1,075 students per year. Combined, the MCESG has a total production capacity of 1,200 MSGs per year who will be assigned to supply one of nine global MSG regions.

F. ASSUMPTIONS

I have made several assumptions about the data used in the model after communicating with subject-matter experts at MCESG. My first assumption is in regards to the loss rate for annual program drops, for which historical data is limited. The only data point that could be obtained were program drops for FY 2012, which indicated about 5%. Therefore, I assume 5% to be about average in the model but can account for a wider range of loss rates in the simulations. It would be logical to assume that because of the ongoing current reductions in military personnel, the limitations in training facilities, the attrition rate, and potential instructor staff shortfalls that no more than five seven week–long classes will convene annually. However, based on the urgency of the DoS Accountability Review Board after Benghazi and the new facilities under construction at Quantico, VA, it is a valid assumption that classes will steadily fill to maximum capacity in FY 2014. Finally, I assume that the end strength for both DetCos and WS have been steady-state prior to the Benghazi attacks. The assumptions for the model are as follows:

1. A 5% loss rate for annual program drops. Limited data was available for actual loss rates for the MSGs prior to FY 2012.
2. MCESG will not convene more than five classes annually.
3. MCESG will be able to recruit and fill each class at maximum capacity.

4. Maximum capacity training will begin in FY 2014.
5. Prior to FY 2013, DetCo MSG strength was 156; prior to FY 2013, WS MSG strength was 1026.
6. An MSG production drawdown or sustainment plan does not currently exist.

G. SUMMARY

This chapter is provided to familiarize the reader with the available data for the expansion plan for the MCESG. Chapter VI details the results and analysis of the model and simulation.

VI. RESULTS AND ANALYSIS

A. OVERVIEW

The MCESG is expanding its operations to meet worldwide security threats at U.S. diplomatic facilities. Since the attack at the U.S. consulate in Benghazi, Libya, Congress authorized the MCESG to expand its MSG end strength. As mentioned in Chapter IV, prior planning between the DoS and MCESG has identified the annual growth requirements (deterministic demand/parameters) needed to support this expansion. It is the purpose of this chapter to present a methodology that could be used to assist the MCESG in identifying the appropriate target trainee demand at the MSG schoolhouse. The target trainee demand is the requirement needed at the MSG schoolhouse to meet the annual growth demands after attrition and annual program drops. MCESG has two trainee demands: DetCos and WSs.

My research revealed that the MSG production plan for expansion entails producing MSGs at maximum capacity over the next four years, FYs 2013 through 2016. Additionally, it was determined that the MCESG does not have a standardized system to assist in the trainee demand planning for the expansion demands. In this chapter, I present a methodology to analyze the MSG production requirements in an effort to determine whether the maximum capacity production plan is the best strategy for the expansion. I present the analysis in the next chapter.

The logic behind the methodology of this model is based on a combination of the Wang, Egudo, and Galanis (2007) study and the financial accounting inventory equation. I also use future value formulas to project the PCS transfers in a given period based on historical data. The inventory equation is given as follows:

Beginning Inventory + Additions – Withdrawals = Ending Inventory (Stickney, 2010).

In this chapter, I use a three-part methodology: first, I describe the model; next, I describe how I simulated the model; and finally, I describe VBA.

B. THE MODEL FRAMEWORK

The goal of this model is to determine the target number of trainees (trainee demand) required to meet the MCESG's expansion demands. The outputs of the model include an annual target number of trainees, tr_t, for a three-year period; an annual expected number of annual graduates, g_e, for a three-year period; and an average number of trainees, a_t, and graduates, a_g, per class over a three-year period. The MCESG training cycle consists of five classes per annum. For the purposes of this model, Years 1, 2, and 3 are synonymous with FYs 2013, 2014, and 2015.

1. Model Limitations

The model application was limited to a three-year outlook in order to use actual graduate data available from prior years (PYs). MSG graduates are assigned to duty on three-year orders; therefore, I assume MSGs will execute PCS orders three years after graduation. However, for the analysis chapter, I use PCS estimation to project through expansion and into sustainment.

2. Parameters

The model in this thesis has two parameters and three variables. The parameters for this model are the expansion targets established by the MCESG. They are identified in this model as start strength, s_s, and target strength, s_t. Table 4 depicts the expansion target parameters required for FYs 2013, FY 2014, and FY 2015.

Table 4. MCESG Expansion Target Parameters

Position	Strength Type	FY 2013	FY 2014	FY 2015
DetCo	Starting Strength = s_s	156 = s_{s1}	163 = s_{s2}	180 = s_{s3}
	Target Strength = s_t	163 = s_{t1}	180 = s_{t2}	195 = s_{t3}
WS	Starting Strength = s_s	1026 = s_{s1}	1185 = s_{s2}	1358 = s_{s3}
	Target Strength = s_t	1185 = s_{t1}	1358 = s_{t2}	1609 = s_{t3}

The start strength, s_s, and the target strength, s_t, are used to determine the target demand and growth rate for the expansion period. Target demand is denoted by Δ and is calculated by the formula $\Delta = s_s - s_t$. The growth rate is denoted by r_Δ and is calculated by the formula $r_\Delta = \frac{\Delta}{s_s}$. Target demands and growth rates are calculated for Year 1, Year 2, and Year 3. Table 6 depicts the future planning output of Model 1 input parameters.

3. Historical Data

Prior year (PY) data is used for calculations of averages and loss rates in the model. The data available for use in the calculations are PY MSG graduates numbers, annual start strength, and annual end strength. PY data for the GoS and RfC categories were only available for FY 2012. This data indicated that 5% of the MSGs were dropped from the program that year. Therefore, I assume 5% to be the average loss rate, l_r, for the model.

a. Program Drops

Marines in the GoS category generally leave the MSG program prior to fulfilling their obligation due to circumstances outside their control (e.g., health issues). GoS is denoted by gos in the formulas. Marines in the RfC category generally leave the MSG program due to disciplinary actions, such as NJP. RfC is denoted by rfc in the formulas. The sum of gos and rfc are averaged to determine the annual MSG program drops. The average MSG program drops are denoted by d_a. The formula for the average program drops is

$$d_a = \left(\frac{(gos_1 + rfc_1 + gos_2 + rfc_2 + gos_3 + rfc_3)}{3}\right)$$

The average program drops, d_a, and the average annual MSG strength are used to calculate the loss rate. Loss rates are used to project the number of MSGs serving at diplomatic facilities that are dropped from the program annually. Loss rates are not the same as attrition rates, which would be used for Marines in training at the MSG Schoolhouse. This model uses graduation rates instead of attrition rates.

b. *Annual Strength*

Starting strength and ending strength data from the three PYs are used to calculate an average annual strength. The average strength is denoted by s_a and is calculated with the average drops, d_a, to determine the average historic loss rate. The loss rate, l_r, formula is $l_r = (\frac{d_a}{s_a})$. Once l_r has been determined the Year 1, 2, and 3 growth rates, r_Δ, are applied to estimate a year specific loss rate. Table 5 presents the loss rate formulas for Years 1, 2, and 3.

Table 5. Loss Rate Formulas

Average	l_r
Year 1	$l_{r_1} = l_r * r_{\Delta_1}$
Year 2	$l_{r_2} = l_{r_1} * r_{\Delta_2}$
Year 3	$l_{r_3} = l_{r_2} * r_{\Delta_3}$

c. *PCS Transfers*

Loss rates, l_r, are applied to actual graduates numbers, g_a, in PYs to accounting for average annual drops and project the expected number of PCS transfers. PCS transfers are denoted by t_e. Table 6 shows the formulas used to determine the expected transfers.

Table 6. Expected PCS Transfer Formulas

Year 1	$t_{e_1} = (g_a * (1 - l_r)^2) * (1 - l_{r_1})$
Year 2	$t_{e_2} = (g_a * (1 - l_r) * (1 - l_{r_1}) * (1 - l_{r_2})$
Year 3	$t_{e_3} = (g_a * (1 - l_{r_1}) * (1 - l_{r_2}) * (1 - l_{r_3})$

d. *Required Graduates*

Average program drops, d_a, and expected PCS transfers, t_e, are the two variables needed to determine the required graduates, or g_r. The sum of d_a and t_e equate

to the total number of personnel lost annually. The personnel lost from the program annually are denoted by l_p. The starting strength, s_s, is reduced by the l_p, calculating the new strength, denoted by s_n. The new strength is deducted from the target strength to project the required number of graduates needed to meet the expansion demand. Required graduates are annotated in an output report in Excel for Years 1, 2, and 3. Table 7 depicts the sequence for calculation of the required graduates.

Table 7. Required Graduate Formulas

Step 1	$g_r = s_t - (s_s - (t_e + d_a))$
Step 2	$g_r = s_t - (s_s - l_p)$
Step 3	$g_r = s_t - s_n$

e. Target Trainees

The required graduates, g_r, are divided by the selected graduation rate to project the required trainee demand needed to produce the required graduates needed to meet the expansion demand. The formula for required trainees is $tr_r = \frac{g_r}{r_g}$. Target trainees are annotated in an output report in Excel for Years 1, 2, and 3. Finally, an average spread of required graduates and target trainees is also annotated in an output report in Excel for Years 1, 2, and 3.

f. Notation

The following is a summary of the notation used in the model.

Δ = target demand (growth)
r_Δ = growth rate
s_s = expected start strength
s_n = new strength
s_e = ending strength
s_t = target strength
d_a = average drops
d_e = expected drops

s_a = average strength (3 year)
t_e = expected transfers
g_a = actual graduates
g_e = expected graduates
l_r = loss rate
n = years
r_g = graduation rate
tr_t = target trainees
a_t = trainee average
a_g = graduate average
l_p = lost personnel

C. THE SIMULATIONS FRAMEWORK

The model was simulated in 48 scenarios addressing both the DetCo and WS trainee demands. Of those scenarios, 24 were developed for each functional position and spread across four FYs, 2013–2016. Each FY scenario had six unique sub-scenarios developed for simulation. Figure 5 depicts the 24 scenarios simulated for DetCo and WS.

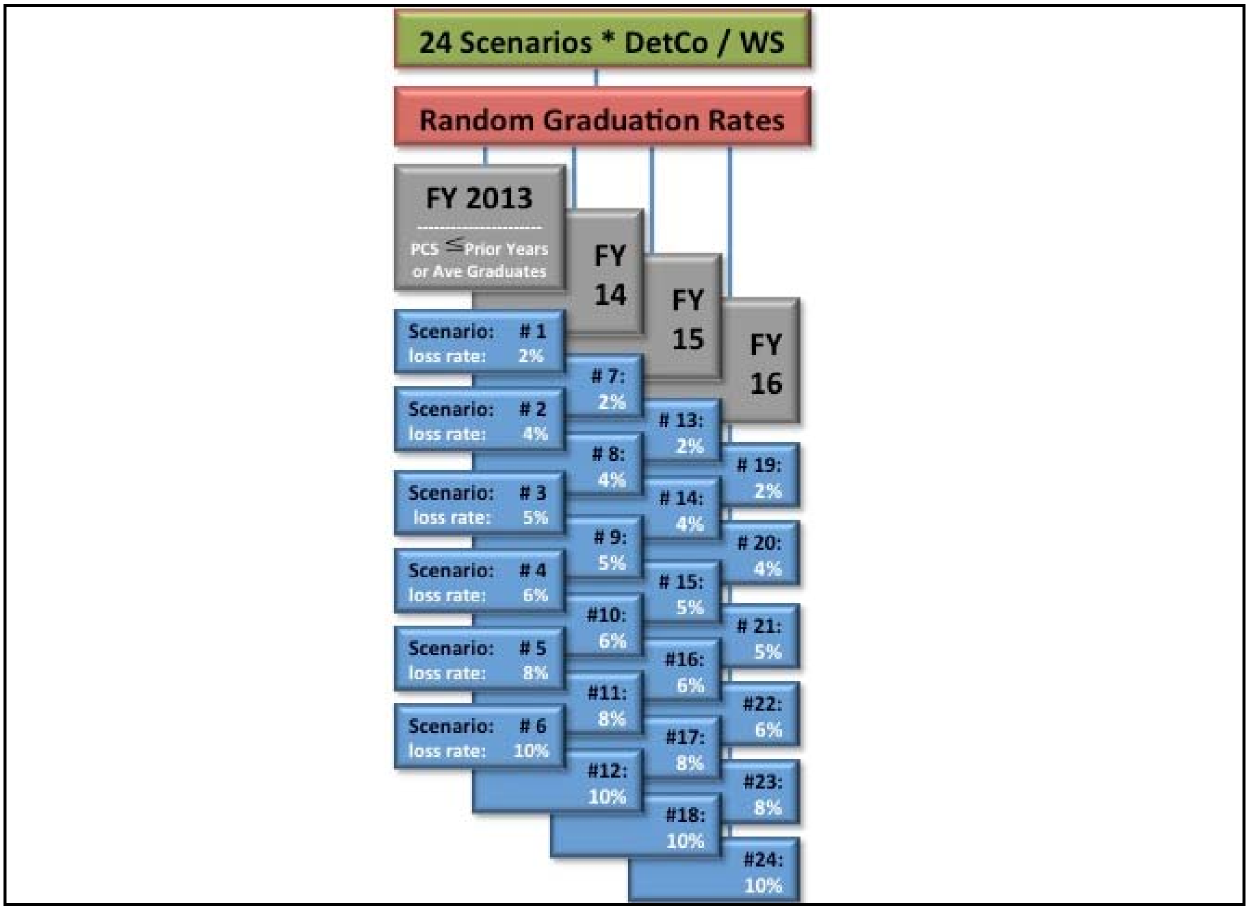

Figure 5. Diagram of Model Scenarios

Each model was constructed with two parameters and three variables. The scenarios' variables consisted of random graduation rates, set PCS transfers, and set program drops.

a. Parameters

The two parameters for this model are the starting strength and target strength. MCESG generated these growth parameters; therefore, I viewed them as constant in the model. The model parameters were displayed previously in Table 4.

b. Variables

This model has three variables: the expected PCS transfers, t_e, the program drops, d_a, and the graduation rates, r_g. The PCS transfers and program drops

are adjusted for each scenario with a new loss rate. The graduation rates are simulated throughout all scenarios.

PCS transfers should roughly equal the number of graduates from three years prior due to assignment on three-year orders. The loss rate, l_r, is applied to the population of FY graduates using a future value formula to estimate how many PCS transfers can be expected in a given period. This is done to account for graduates lost from the MSG program over the course of three years. The model uses actual FY 2010, FY 2011, and FY 2012 graduate numbers to estimate the number of expected PCS transfers in FYs 2013, 2014, and, 2015. The FY 2013 data is not currently available; therefore, the FYs 2006–2012 graduate averages are used to project the FY 2016 PCS transfers.

A loss rate is defined as the proportion of MSGs that leave the program prematurely due to health or legal issues. Limited data was available for actual loss rates for the MSGs prior to FY 2012. In FY 2012, 54 of 1,182 MSGs were program drops; therefore, I assume that the average annual loss rate is 5%. The 48 scenarios were conducted using 2%, 4%, 5%, 6%, 8%, and 10% loss rates.

Graduation rates are applied to the number of graduates calculated in the model to determine the number of trainees required to meet demand. Data were available from FY 2006 to the second quarter of 2013. During that period, 37 classes were completed, providing a solid base for simulating the graduation rates. Graduation rates were simulated in all 48 scenarios. Figure 6 depicts the flow of the simulations.

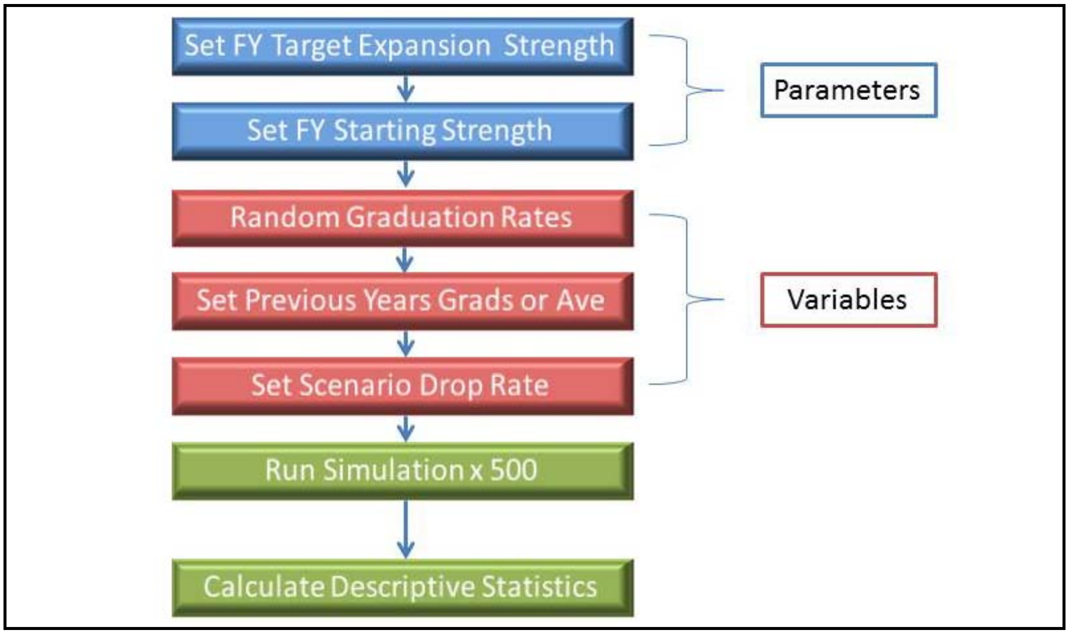

Figure 6. Diagram of Model Simulation Flow

D. VBA IMPLEMENTATION

The analytical method disclosed in Section B of this chapter is implemented in Excel through a VBA UserFrom.

When the user opens the Excel document, they are presented with two worksheets, “Data” and “Calculations.” On the Data worksheet the user encounters two tables for input of data for both positions of the 8156 MOS. Each table has five categories for the user to input and maintain historic and future planning data: GoS, RfC, beginning strength, ending strength and graduates from PYs.

Above these Data worksheet tables is an “Interface” button, which produces a VBA UserForm when clicked. At the top of the UserForm, the planner has the option of selecting either the DetCo or WS position. The UserForm is automatically populated with the appropriate data from the Data worksheet once it appears or a new position is selected. Once the user has verified all the data, the “Execute” button should be clicked and a Results box appears with the requested results. To restart the UserForm for a new calculation, click “Ok” on the Results box and the UserForm reappears. The Data worksheet is displayed in Appendix D.

In the Calculations worksheet is the actual model, which also holds all the input and output data as well as the formulas used in the model's calculations. The Calculations worksheet is displayed in Appendix D.

E. INTERPRETATION OF THE RESULTS

1. Graduation Rates

First, I present the results of the graduation rate analysis that was done as a foundation in the model's development. Operating on the premise that the MCESG will be able to fill each class to maximum capacity, I analyzed the graduation rates, which were a key variable. Using the data from FY 2006 until the second quarter of 2013, I determined a computation of the graduation rates statistical averages to be 74% for DetCos students and 78% for WS students. Using these averages in the actual model, I created a what-if analysis chart based on the range of historic graduation rates. This chart gives the user an overview at a glance of the number of Marines required to begin MSG training in order to satisfy expansion demands. Enclosed in Appendix A are the graduation rate discrete probability distributions used in the simulations and the graduation rate descriptive statistics. The what-if analysis chart is located in Appendix B.

2. Maximum Capacity Production Simulation

A simulation was conducted for both DetCo and WS maximum capacity classes. This simulation was done to identify the expected production results of the maximum capacity plan for analysis against the model's results. The maximum capacity simulation of 125 DetCo trainees yielded an average of 92 DetCo MSGs per annum. The subsequent maximum capacity simulation of 25 DetCo trainees yielded an average of 18 DetCo MSGs produced per class. Conducting the same maximum capacity simulation for 1,075 WS trainees yielded an average of 834 WS MSGs per annum. Follow-on simulation of 215 WS trainees yielded an average of 168 DetCos produced per class. Table 8 displays the results of these simulations.

Table 8. Simulated Maximum Capacity Production Results

Maximum Capacity Data						
	DetCo			Watchstanders		
Position	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Target trainees	98	125	125	847	1075	1075
Required graduates	73	92	92	635	834	834
Target trainees per class	20	25	25	169	215	215
Required graduates per class	15	18	18	131	168	168

3. Model Analysis

The model was first executed with the actual average graduation rates that assumed average loss rate, and the actual graduation data for PCS transfers. The model can be found in Appendix D. Table 9 displays the results of the model.

Table 9. Model Results

Output Data						
	DetCo			Watchstanders		
Position	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Target trainees	83	95	92	739	579	820
Required graduates	61	70	68	576	452	639
Target trainees per class	17	19	18	148	116	164
Required graduates per class	12	14	14	115	90	128

4. Simulated Scenario Analysis

The model was next simulated in 48 different scenarios. Each scenario included simulated graduation rates and a different loss rate. Six scenarios were executed for each FY. The loss rate scenarios were 2%, 4%, 5%, 6%, 8%, and 10%, with 5% assumed to be the average loss rate. All of the loss rate scenarios results are depicted in graph format in Appendix E. Table 10 presents the numerical results of the 48 simulated scenarios.

Table 10. Simulated Scenario Results

	Detachment Commanders							
FY	13		14		15		16	
	Trainees	Grads	Trainees	Grads	Trainees	Grads	Trainees	Grads
2%	89	62	102	70	99	69	104	73
4%	89	63	105	72	100	70	106	75
5%	90	64	105	73	100	71	109	76
6%	92	64	107	73	103	72	110	77
8%	93	65	106	75	107	74	112	79
10%	95	67	108	76	110	76	115	81

	Watchstanders							
FY	13		14		15		16	
	Trainees	Grads	Trainees	Grads	Trainees	Grads	Trainees	Grads
2%	766	585	571	441	835	646	753	584
4%	770	591	594	457	860	661	794	605
5%	773	594	602	465	866	668	800	615
6%	777	597	619	473	871	676	820	625
8%	782	604	640	489	903	691	837	646
10%	792	611	655	505	920	707	869	667

The analysis of the maximum capacity training plan compared to the model output for FYs 2013 through 2016 shows an average three-year surplus of 29% and 44% for DetCo and WS MSGs, respectively. On average, this equates to a surplus of 26 DetCo and 286 WS MSGs trained annually between FYs 2013 through 2016. Table 11 displays the annual surplus percentages for each position.

Table 11. Surplus of Maximum Capacity Production Plan

Training Demand Analysis: Max vs Model						
	DetCo			Watchstanders		
	FY 13	FY 14	FY 15	FY 13	FY 14	FY 15
Max capacity trainees	98	125	125	847	1075	1075
Model recommended trainees	83	95	92	739	579	820
Delta	15	30	33	108	496	255
Max capacity trainee surplus	18%	32%	36%	15%	86%	31%

Further analysis of the maximum capacity plan against the high and low loss rate scenarios for FYs 2013 through 2016 was conducted. The maximum capacity plan still held surpluses against both of the simulated scenarios. On average, the maximum capacity plan had a surplus of 11% and 28% over the 10% loss rate scenario. Table 12

shows the surplus percentages for the simulated high and low scenarios versus the maximum capacity plan.

Table 12. Maximum Capacity vs. Simulated Maximum and Minimum Loss Rate Scenarios

Training Demand Analysis: Max vs Simulation								
	DetCo				Watchstanders			
	FY 13	FY 14	FY 15	FY 16	FY 13	FY 14	FY 15	FY 16
Max capacity trainees	98	125	125	125	847	1075	1075	1075
2%	89	102	99	104	766	571	835	753
Delta	9	23	26	21	81	504	240	322
Max capacity trainee surplus	10%	23%	26%	20%	11%	88%	29%	43%
Max capacity trainees	98	125	125	125	847	1075	1075	1075
10%	95	108	110	115	792	655	920	869
Delta	3	17	15	10	55	420	155	206
Max capacity trainee surplus	3%	16%	14%	9%	7%	64%	17%	24%

Of particular interest in the findings are the projected WS surplus rates for FY 2014. The surplus rates range from a high of 88% to a low of 64%, which is an outlier in the surplus data. My research concludes that this is due to the fact that the actual WS graduates in FY 2011 numbered 253 MSGs. The average number of WS graduates for the class from FY 2006 through the second quarter of 2013 is 359 MSGs, which means the FY 2011 class of WSs was 42% less than the average. The descriptive statistics for the average graduate rates can be found in Appendix A.

F. SUMMARY

In this chapter, I reviewed the model, results, and analysis of this thesis. Based on the analysis of the results, the model presents a potential planning tool that could assist decision-makers in determining the trainee demands of expansion and sustainment in the future.

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CONCLUSION AND RECOMMENDATIONS

G. SUMMARY

On September 11, 2012, the U.S. Consulate in Benghazi, Libya, was attacked, resulting in the death of four United States citizens, including the U.S. Ambassador, Chris Stevens. Prior to the attacks in Benghazi, the MCESG held a total strength of approximately 1,392 Marines, of which 1,196 were MSGs. In the aftermath of this attack, "Congress authorized growth of up to 1,000 Marines for embassy security" (MCESG, 2013). During my research, I discovered through subject-matter experts that the MCESG plans to produce MSGs at maximum capacity in the coming years. In this thesis, I analyzed the trainee demands required for the expansion of the MCESG and proposed an effective methodology that can assist the MCESG operations personnel plan for the expansion and future force sustainment. The proposed methodology is founded on a recent study from an Australian team (Wang, Egudo, & Galanis, 2007) that has been adapted to fit the decision environment faced by the MCESG operation personnel team. The model has also been adjusted to account for uncertainty in decision-making by incorporating Monte Carlo simulations to increase the efficiency of the decision-making process. In addition, I presented in this thesis an operational UserForm interface of the model that is easy to use and adjust to account for changing operational needs for expansion or sustainment.

H. MODEL EVOLUTION

The development of the methodology is based on a recent Australian Department of Defence study titled, *Determining Training Demands for an Expanding Military Organisation* (Wang, Egudo, & Galanis, 2007). The model in the Australian study used techniques that helped build a foundation for the mathematical concepts in this model and inspired the VBA UserForm developed for this thesis. I built upon the model used specifically for the MCESG operations personnel to determine trainee demands for the current expansion. Assumptions were made in the thesis model where information was lacking. However, the model stands as a proof of concept that development of such a

DSS can be useful at the MCESG and other training commands without such tools. The model developed in this thesis can be improved upon with

- additional data points to minimize assumptions,
- expanded UserForm capabilities to include graphs or charts,
- expanded model capabilities to assist in determining instructor demands in the training command, and
- expanded model capabilities to project trainee demands for classes; this model averages the annual outputs among the five classes and could be refined to better serve the planning purposes of the MCESG.

I. MODEL FINDINGS

The findings of this thesis indicate that the proposed methodology could yield significant savings in terms of manpower and training requirements for the MCESG. During simulation, it was determined that the surplus of DetCos could range from 3% to 26%, dependent on a high or low loss rate. It was also determined that the surplus of WSs could range from 7% to 88%, dependent on a high or low loss rate. When the model was run using the average loss rate, 5%, and the average graduation rates, it was calculated that the maximum production capacity trainee plan could yield a surplus of approximately 86% more WSs in FY 2014 alone. Based on these findings, it appears that the methodology used in this thesis could be of use for operational planners in the future. This model's results should be considered supplemental and advisory in nature to the MCESG's planning efforts.

APPENDIX A: MARINE SECURITY GUARD GRADUATION DATA

	CLASS TOTALS 2006					
		SNCO			MSG	
2006	TOTAL REPORTED	TOTAL DROPS	TOTAL GRADUATED	TOTAL REPORTED	TOTAL DROPS	TOTAL GRADUATED
1-06	14	1	13	109	17	92
2-06	11	1	10	99	13	86
3-06	10	1	9	103	12	91
4-06	17	3	14	94	14	80
5-06	17	2	15	94	9	85
TOTAL	69	8	61	499	65	434
	CLASS TOTALS 2007					
		SNCO			MSG	
2007	TOTAL REPORTED	TOTAL DROPS	TOTAL GRADUATED	TOTAL REPORTED	TOTAL DROPS	TOTAL GRADUATED
1-07	11	1	10	88	16	72
2-07	13	0	13	62	8	54
3-07	9	1	8	45	13	32
4-07	13	1	12	63	10	53
5-07	11	3	8	76	13	63
TOTAL	57	6	51	334	60	274
	CLASS TOTALS 2008					
		SNCO			MSG	
2008	TOTAL REPORTED	TOTAL DROPS	TOTAL GRADUATED	TOTAL REPORTED	TOTAL DROPS	TOTAL GRADUATED
1-08	14	3	11	86	14	72
2-08	15	3	12	70	8	62
3-08	17	5	12	53	14	39
4-08	25	5	20	78	14	64
5-08	22	2	20	101	13	88
TOTAL	93	18	75	388	63	325
	CLASS TOTALS 2009					
		SNCO			MSG	
2009	TOTAL REPORTED	TOTAL DROPS	TOTAL GRADUATED	TOTAL REPORTED	TOTAL DROPS	TOTAL GRADUATED
1-09	18	9	9	120	22	98
2-09	11	3	8	110	34	76
3-09	8	2	6	116	26	90
4-09	17	3	14	92	15	77
5-09	15	4	11	115	28	87
TOTAL	69	21	48	553	125	428

	CLASS TOTALS 2010					
		SNCO			MSG	
2010	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL
	REPORTED	DROPS	GRADUATED	REPORTED	DROPS	GRADUATED
1-10	15	2	13	108	20	88
2-10	13	6	7	121	26	95
3-10	14	6	8	115	26	89
4-10	17	7	10	115	29	86
5-10	21	5	16	85	23	63
TOTAL	80	26	54	544	124	421
	CLASS TOTALS 2011					
		SNCO			MSG	
2011	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL
	REPORTED	DROPS	GRADUATED	REPORTED	DROPS	GRADUATED
1-11	19	4	15	87	21	66
2-11	19	8	11	97	31	66
3-11	9	2	7	76	24	52
4-11	9	4	5	41	15	26
5-11	20	6	14	64	21	43
TOTAL	76	24	52	365	112	253
	CLASS TOTALS 2012					
		SNCO			MSG	
2011	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL
	REPORTED	DROPS	GRADUATED	REPORTED	DROPS	GRADUATED
1-11	13	5	8	72	15	50
2-11	16	3	12	106	26	73
3-11	17	5	11	122	19	91
4-11	25	11	12	132	38	89
5-11	24	11	9	121	36	77
TOTAL	95	35	52	553	134	380
	CLASS TOTALS 2013					
		SNCO			MSG	
2011	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	TOTAL
	REPORTED	DROPS	GRADUATED	REPORTED	DROPS	GRADUATED
1-11	22	6	16	149	21	125
2-11	26	6	20	131	13	118
3-11	x	x	x	x	x	x
4-11	x	x	x	x	x	x
5-11	x	x	x	x	x	x
TOTAL	48	12	36	280	34	243

Average DetCo Grad Rate	
Mean	0.743759333
Standard Error	0.024083334
Median	0.761904762
Mode	0.909090909
Standard Deviation	0.146493203
Sample Variance	0.021460258
Kurtosis	-0.205543647
Skewness	-0.55458956
Range	0.625
Minimum	0.375
Maximum	1
Sum	27.51909531
Count	37
Confidence Level(95.0%)	0.048843266

Average WS Grad Rate	
Mean	0.781647153
Standard Error	0.013031143
Median	0.785123967
Mode	#N/A
Standard Deviation	0.079265349
Sample Variance	0.006282996
Kurtosis	-1.140271288
Skewness	-0.248839663
Range	0.270108978
Minimum	0.634146341
Maximum	0.904255319
Sum	28.92094466
Count	37
Confidence Level(95.0%)	0.026428383

Average DetCo Graduates	
Mean	56.14286
Standard Error	3.487587
Median	52
Mode	52
Standard Deviation	9.227289
Sample Variance	85.14286
Kurtosis	3.142969
Skewness	1.779628
Range	27
Minimum	48
Maximum	75
Sum	393
Count	7
Confidence Level(95.0%)	8.533819

Average WS Graduates	
Mean	359.2857
Standard Error	28.57214
Median	380
Mode	#N/A
Standard Deviation	75.59478
Sample Variance	5714.571
Kurtosis	-1.82676
Skewness	-0.47308
Range	181
Minimum	253
Maximum	434
Sum	2515
Count	7
Confidence Level(95.0%)	69.91351

DetCo Graduation Rate Distro . FY 2006 - FY 2013 (FY13 1st & 2nd Qtr)

Grad rates	Probability	Frequency	Probability	Cumulative	Random Interval Range	
38%	0.03	1	0.03	0.03	0.00	0.03
48%	0.03	1	0.03	0.06	0.04	0.06
50%	0.03	1	0.03	0.08	0.07	0.08
54%	0.03	1	0.03	0.11	0.09	0.11
56%	0.03	1	0.03	0.14	0.12	0.14
57%	0.03	1	0.03	0.17	0.15	0.17
58%	0.03	1	0.03	0.19	0.18	0.19
59%	0.03	1	0.03	0.22	0.20	0.22
62%	0.03	1	0.03	0.25	0.23	0.25
65%	0.03	1	0.03	0.27	0.26	0.27
70%	0.03	1	0.03	0.30	0.28	0.30
71%	0.03	1	0.03	0.33	0.31	0.33
73%	0.11	4	0.11	0.44	0.34	0.44
75%	0.05	2	0.05	0.49	0.45	0.49
76%	0.03	1	0.03	0.52	0.50	0.52
77%	0.03	1	0.03	0.54	0.53	0.54
78%	0.03	1	0.03	0.57	0.55	0.57
79%	0.05	2	0.05	0.62	0.58	0.62
80%	0.05	2	0.05	0.68	0.63	0.68
82%	0.05	2	0.05	0.73	0.69	0.73
87%	0.03	1	0.03	0.76	0.74	0.76
88%	0.03	1	0.03	0.79	0.77	0.79
89%	0.03	1	0.03	0.81	0.80	0.81
90%	0.03	1	0.03	0.84	0.82	0.84
91%	0.08	3	0.08	0.92	0.85	0.92
92%	0.03	1	0.03	0.95	0.93	0.95
93%	0.03	1	0.03	0.98	0.96	0.98
100%	0.03	1	0.03	1.00	0.99	1.00
Total frequency		**37**				
Average grad rates		**74%**				
Random number		**0.09**				
Simulated DetCo grad rat		**54%**				

WS Graduation Rate Distro . FY 2006 - FY 2013 (FY13 1st & 2nd Qtr)

Grad rates	Probability	Frequency	Probability	Cumulative	Random Interval Range	
63%	0.03	1	0.03	0.03	0.00	0.03
64%	0.03	1	0.03	0.06	0.04	0.06
67%	0.05	2	0.05	0.11	0.07	0.11
68%	0.05	2	0.05	0.17	0.12	0.17
69%	0.08	3	0.08	0.25	0.18	0.25
71%	0.03	1	0.03	0.27	0.26	0.27
74%	0.05	2	0.05	0.33	0.28	0.33
75%	0.05	2	0.05	0.38	0.34	0.38
76%	0.05	2	0.05	0.44	0.39	0.44
77%	0.03	1	0.03	0.46	0.45	0.46
78%	0.03	1	0.03	0.49	0.47	0.49
79%	0.03	1	0.03	0.52	0.50	0.52
81%	0.03	1	0.03	0.54	0.53	0.54
82%	0.08	3	0.08	0.62	0.55	0.62
83%	0.03	1	0.03	0.65	0.63	0.65
84%	0.14	5	0.14	0.79	0.66	0.79
85%	0.03	1	0.03	0.81	0.80	0.81
87%	0.08	3	0.08	0.89	0.82	0.89
88%	0.03	1	0.03	0.92	0.90	0.92
89%	0.03	1	0.03	0.95	0.93	0.95
90%	0.05	2	0.05	1.00	0.96	1.00

Total frequency	**37**
Average grad rates	**78%**
Random number	**0.88**
Simulated DetCo grad	**87%**

APPENDIX B: WHAT-IF ANALYSIS CHART

Model "What If Analysis" for Detachment Commander Graduation Rates								
DetCo Graduation Rates	FY 2013 Target Trainees	FY 2013 Expected Graduates	DetCo Graduation Rates	FY 2014 Target Trainees	FY 2014 Expected Graduates	DetCo Graduation Rates	FY 2015 Target Trainees	FY 2015 Expected Graduates
74%	**83**	**61**	**74%**	**95**	**70**	**74%**	**92**	68
38%	163	**61**	38%	187	**70**	38%	182	**68**
48%	128	**61**	48%	146	**70**	48%	142	**68**
50%	123	**61**	50%	140	**70**	50%	137	**68**
54%	114	**61**	54%	130	**70**	54%	127	**68**
56%	110	**61**	56%	126	**70**	56%	123	**68**
57%	107	**61**	57%	123	**70**	57%	120	**68**
58%	106	**61**	58%	121	**70**	58%	118	**68**
59%	104	**61**	59%	119	**70**	59%	116	**68**
62%	100	**61**	62%	114	**70**	62%	111	**68**
65%	95	**61**	65%	108	**70**	65%	106	**68**
70%	88	**61**	70%	100	**70**	70%	98	**68**
71%	87	**61**	71%	99	**70**	71%	97	**68**
73%	84	**61**	73%	96	**70**	73%	94	**68**
75%	82	**61**	75%	94	**70**	75%	91	**68**
76%	80	**61**	76%	92	**70**	76%	90	**68**
77%	80	**61**	77%	91	**70**	77%	89	**68**
78%	79	**61**	78%	90	**70**	78%	88	**68**
79%	78	**61**	79%	89	**70**	79%	87	**68**
80%	77	**61**	80%	88	**70**	80%	85	**68**
82%	74	**61**	82%	85	**70**	82%	83	**68**
87%	71	**61**	87%	81	**70**	87%	79	**68**
88%	69	**61**	88%	79	**70**	88%	77	**68**
89%	69	**61**	89%	79	**70**	89%	77	**68**
90%	68	**61**	90%	78	**70**	90%	76	**68**
91%	67	**61**	91%	77	**70**	91%	75	**68**
92%	66	**61**	92%	76	**70**	92%	74	**68**
93%	66	**61**	93%	76	**70**	93%	74	**68**
100%	61	**61**	100%	70	**70**	100%	68	**68**
DetCo average graduation rate from 2006 - 2nd Quarter 2013: 74%								

Model "What If Analysis" for Watchstander Graduation Rates								
DetCo Graduation Rates	**FY 2013 Target Trainees**	**FY 2013 Expected Graduates**	**DetCo Graduation Rates**	**FY 2014 Target Trainees**	**FY 2014 Expected Graduates**	**DetCo Graduation Rates**	**FY 2015 Target Trainees**	**FY 2015 Expected Graduates**
78%	**739**	**576**	**78%**	**579**	**452**	**78%**	**820**	640
63%	909	**576**	63%	712	**452**	63%	1008	**639**
64%	906	**576**	64%	710	**452**	64%	1005	**639**
67%	858	**576**	67%	672	**452**	67%	951	**639**
68%	847	**576**	68%	664	**452**	68%	940	**639**
69%	837	**576**	69%	656	**452**	69%	928	**639**
71%	810	**576**	71%	635	**452**	71%	899	**639**
74%	783	**576**	74%	614	**452**	74%	869	**639**
75%	773	**576**	75%	606	**452**	75%	857	**639**
76%	762	**576**	76%	597	**452**	76%	845	**639**
77%	745	**576**	77%	584	**452**	77%	826	**639**
78%	743	**576**	78%	582	**452**	78%	824	**639**
79%	734	**576**	79%	575	**452**	79%	814	**639**
81%	707	**576**	81%	554	**452**	81%	785	**639**
82%	706	**576**	82%	553	**452**	82%	783	**639**
83%	695	**576**	83%	545	**452**	83%	771	**639**
84%	689	**576**	84%	540	**452**	84%	764	**639**
85%	677	**576**	85%	531	**452**	85%	751	**639**
87%	663	**576**	87%	520	**452**	87%	736	**639**
88%	652	**576**	88%	511	**452**	88%	724	**639**
89%	651	**576**	89%	510	**452**	89%	722	**639**
90%	640	**576**	90%	501	**452**	90%	710	**639**
Watchstander average graduation rate from 2006 - 2nd Quarter 2013: 78%								

APPENDIX C: MAXIMUM CAPACITY DATA

Input: 125 Marines

Max: Annual DetCo Graduates	
Mean	91.98845634
Standard Error	0.857553839
Median	95.23809524
Mode	90.90909091
Standard Deviation	19.17548678
Sample Variance	367.6992933
Kurtosis	-0.334524646
Skewness	-0.638033341
Range	78.125
Minimum	46.875
Maximum	125
Sum	45994.22817
Count	500
Confidence Level(95.0%)	1.684861232

Input: 25 Marines

Max: Class DetCo Graduates	
Mean	18.31838673
Standard Error	0.164078104
Median	18.75
Mode	18.18181818
Standard Deviation	3.668897941
Sample Variance	13.4608121
Kurtosis	-0.501625529
Skewness	-0.46871263
Range	15.625
Minimum	9.375
Maximum	25
Sum	9159.193364
Count	500
Confidence Level(95.0%)	0.322369073

Input: 1075 Marines

Max: Annual WS Graduates	
Mean	834.16087685
Standard Error	3.76988729
Median	844.00826446
Mode	899.72826087
Standard Deviation	84.29724248
Sample Variance	7106.02508955
Kurtosis	-1.19823448
Skewness	-0.22854627
Range	286.61329361
Minimum	681.70731707
Maximum	968.32061069
Sum	417080.43842395
Count	500.00000000
Confidence Level(95.0%)	7.40680836

Input: 215 Marines

Max: Class WS Graduates	
Mean	167.90387809
Standard Error	0.75587477
Median	171.99341904
Mode	179.94565217
Standard Deviation	16.90187363
Sample Variance	285.67333221
Kurtosis	-1.05112603
Skewness	-0.33168964
Range	57.32265872
Minimum	136.34146341
Maximum	193.66412214
Sum	83951.93904673
Count	500.00000000
Confidence Level(95.0%)	1.48508937

APPENDIX D: THE MODEL

8156 MOS Data

Interface

Detachment Commanders					
	All 8156 Marines				School house
FY	Goods of Service (GoS)	Release for Cause (RFC)	Beginning strength	Ending strength	PY Graduates
2010	3	5	156	156	54
2011	4	4	156	156	52
2012	5	3	156	156	52
2013	x	x	156	163	x
2014	x	x	163	180	x
2015	x	x	180	195	x
2016	x	x	195	210	x
2017	x	x	210	210	x
2018	x	x	210	210	x
2019	x	x	210	210	x
2020	x	x	210	210	x

(DetCo Data Worksheet with UserForm Interface Button)

Input		Detachment Commanders		
		Y1	Y2	Y3
Starting Strength		156	163	180
Target Strength		163	180	195
Target Demand		7	17	15
Growth Rate		4%	10%	8%
		PY3	PY2	PY1
Goods Of Service		3	4	5
Release For Cause		4	4	4
Beginning Strength		150	150	156
Ending Strength		150	156	156
Graduates		54	52	52
Graduation rate		74%	74%	74%

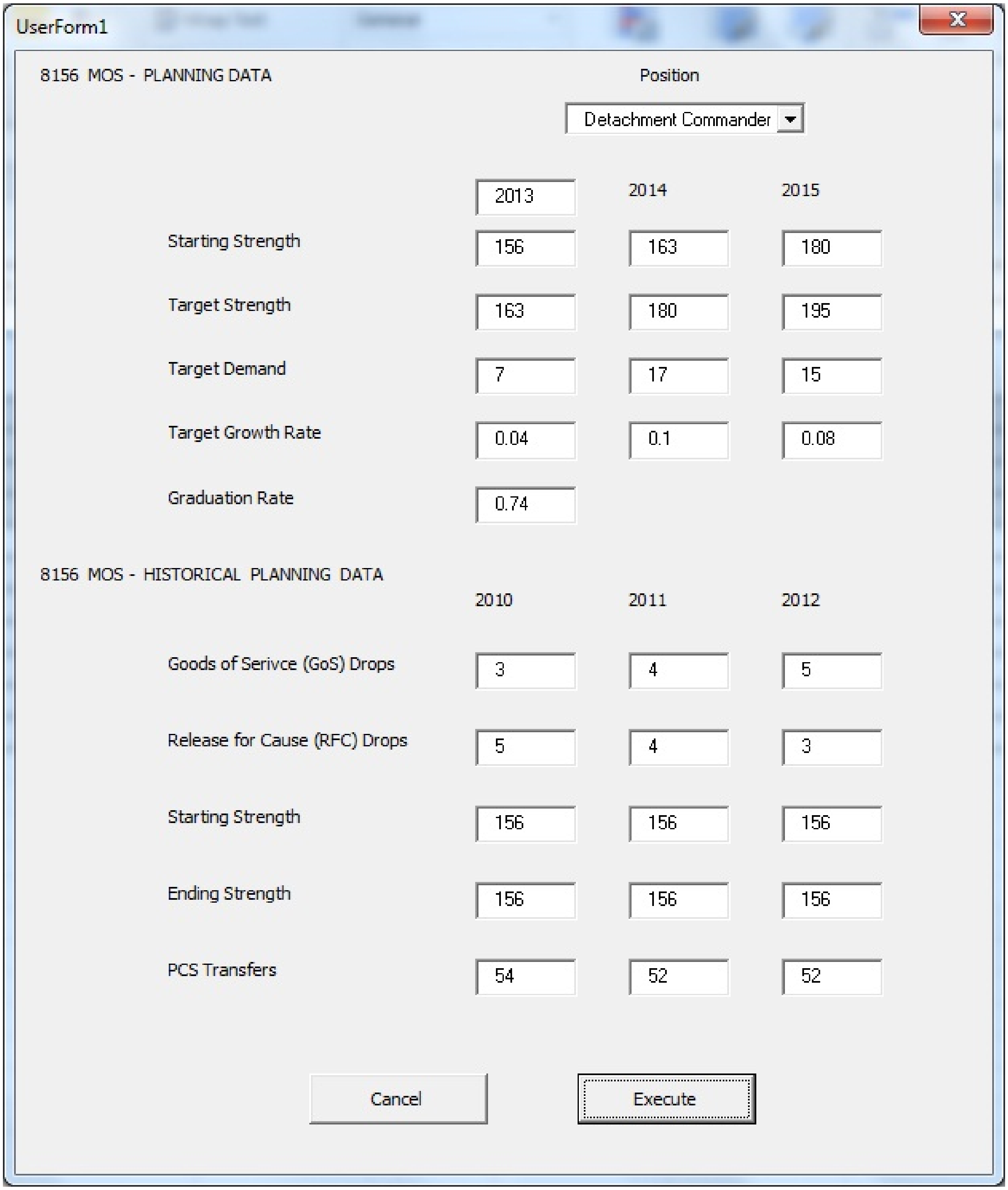
		Watchstanders		
		Y1	Y2	Y3
Starting Strength		1026	1185	1358
Target Strength		1185	1358	1609
Target Demand		159	173	251
Growth Rate		15%	15%	18%
		PY3	PY2	PY1
Goods Of Service		25	25	25
Release For Cause		25	25	25
Beginning Strength		1026	1026	1026
Ending Strength		1026	1026	1026
Graduates		421	253	380
Graduation rate		78%	78%	78%

DetCo Formulas		
	Future Planning Data	
Step 1	Target Demand year 1	7
	Target Demand year 2	17
	Target Demand year 3	15
Step 2	Growth rate year 1	4%
	Growth rate year 2	10%
	Growth rate year 3	8%
	Historical	
Step 3	Ave drops prior 3 years	8
	Expected drops (w/growth) year 1	8
	Expected drops (w/growth) year 2	9
	Expected drops (w/growth) year 3	10
Step 4	Ave strength prior 3 years	153
Step 5	Ave Loss rate	5%
Step 6	Loss rate (w/growth) year 1	5%
	Loss rate (w/growth) year 2	6%
	Loss rate (w/growth) year 3	7%
Step 7	Expected PCS Transfers year 1	46
	Expected PCS Transfers year 2	44
	Expected PCS Transfers year 3	43
Step 8	Projected ave annual personel lost	53
Step 9	Expected graduates year 1	61
	Expected graduates year 2	70
	Expected graduates year 3	68
Step 10	Target trainees year 1	83
	Target trainees year 2	95
	Target trainees year 3	92
Step 11	Target trainees / class year 1	17
	Target trainees / class year 2	19
	Target trainees / class year 3	18
Step 12	Expected graduates per class year 1	12
	Expected graduates per class year 2	14
	Expected graduates per class year 3	14

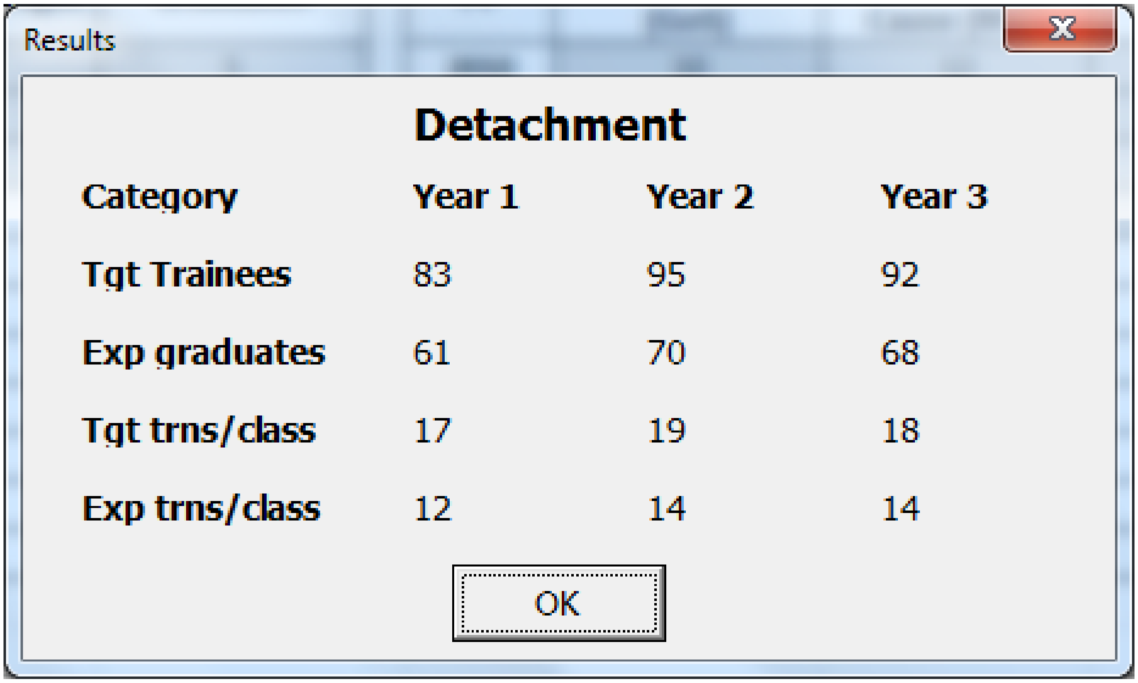
(Calculations Worksheet: Part 1)

Watchstander Formulas		
	Future Planning Data	
Step 1	Target Demand year 1	159
	Target Demand year 2	173
	Target Demand year 3	251
Step 2	Growth rate year 1	15%
	Growth rate year 2	15%
	Growth rate year 3	18%
	Historical	
Step 3	Ave drops prior 3 years	50
	Expected drops (w/growth) year 1	58
	Expected drops (w/growth) year 2	66
	Expected drops (w/growth) year 3	78
Step 4	Ave strength prior 3 years	1026
Step 5	Ave Loss rate	5%
Step 6	Loss rate (w/growth) year 1	6%
	Loss rate (w/growth) year 2	6%
	Loss rate (w/growth) year 3	8%
Step 7	Expected PCS Transfers year 1	360
	Expected PCS Transfers year 2	213
	Expected PCS Transfers year 3	310
Step 8	Projected ave annual personel lost	361
Step 9	Expected graduates year 1	576
	Expected graduates year 2	452
	Expected graduates year 3	639
Step 10	Target trainees year 1	739
	Target trainees year 2	579
	Target trainees year 3	819
Step 11	Target trainees / class year 1	148
	Target trainees / class year 2	116
	Target trainees / class year 3	164
Step 12	Expected graduates per class year 1	115
	Expected graduates per class year 2	90
	Expected graduates per class year 3	128

Marine Security Guard Planning Report						
Input Data						
	DetCo			**Watchstanders**		
Category	**Year 1**	**Year 2**	**Year 3**	**Year 1**	**Year 2**	**Year 3**
Starting Strength	156	163	180	1026	1185	1358
Target Strength	163	180	195	1185	1358	1609
Target Demand	7	17	15	159	173	251
Growth Rate	4%	10%	8%	15%	15%	18%
Graduation Rate	74%	74%	74%	78%	78%	78%
Output Data						
	DetCo			**Watchstanders**		
Category	**Year 1**	**Year 2**	**Year 3**	**Year 1**	**Year 2**	**Year 3**
Target trainees	83	95	92	739	579	819
Expected graduates	61	70	68	576	452	639
Target trainees per class	17	19	18	148	116	164
Expected graduates per class	12	14	14	115	90	128



(VBA UserForm for DetCo Position)



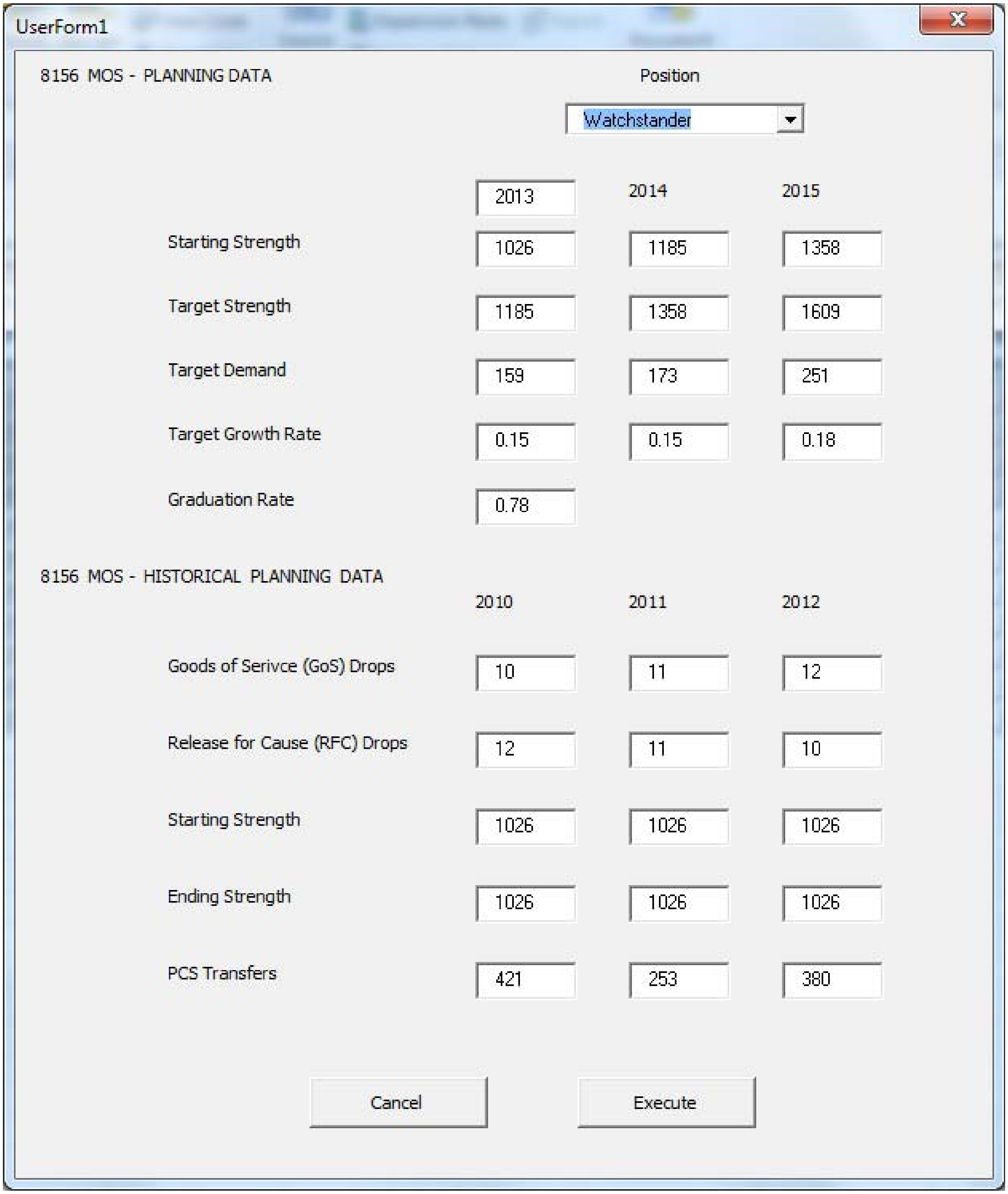
Results

Detachment

Category	Year 1	Year 2	Year 3
Tgt Trainees	83	95	92
Exp graduates	61	70	68
Tgt trns/class	17	19	18
Exp trns/class	12	14	14

OK

(VBA Results Box for DetCo Position)



UserForm1

8156 MOS - PLANNING DATA

Position: Watchstander

	2013	2014	2015
Starting Strength	1026	1185	1358
Target Strength	1185	1358	1609
Target Demand	159	173	251
Target Growth Rate	0.15	0.15	0.18
Graduation Rate	0.78		

8156 MOS - HISTORICAL PLANNING DATA

	2010	2011	2012
Goods of Serivce (GoS) Drops	10	11	12
Release for Cause (RFC) Drops	12	11	10
Starting Strength	1026	1026	1026
Ending Strength	1026	1026	1026
PCS Transfers	421	253	380

Cancel Execute

(VBA UserForm for WS Position)

Results

Watchstander

Category	Year 1	Year 2	Year 3
Tgt Trainees	739	578	819
Exp graduates	576	451	639
Tgt trns/class	148	116	164
Exp trns/class	115	90	128

OK

(VBA Results Box for WS Position)

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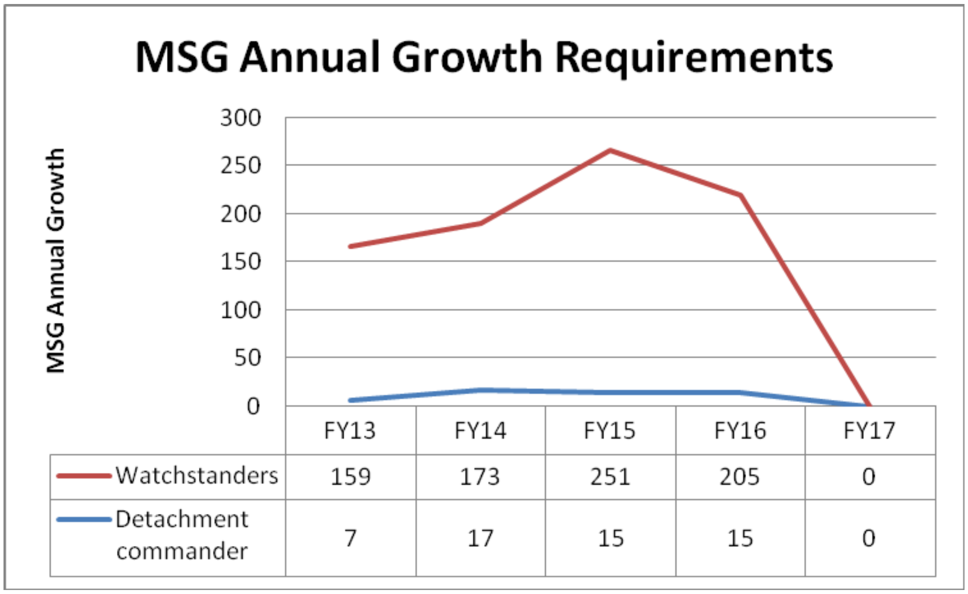
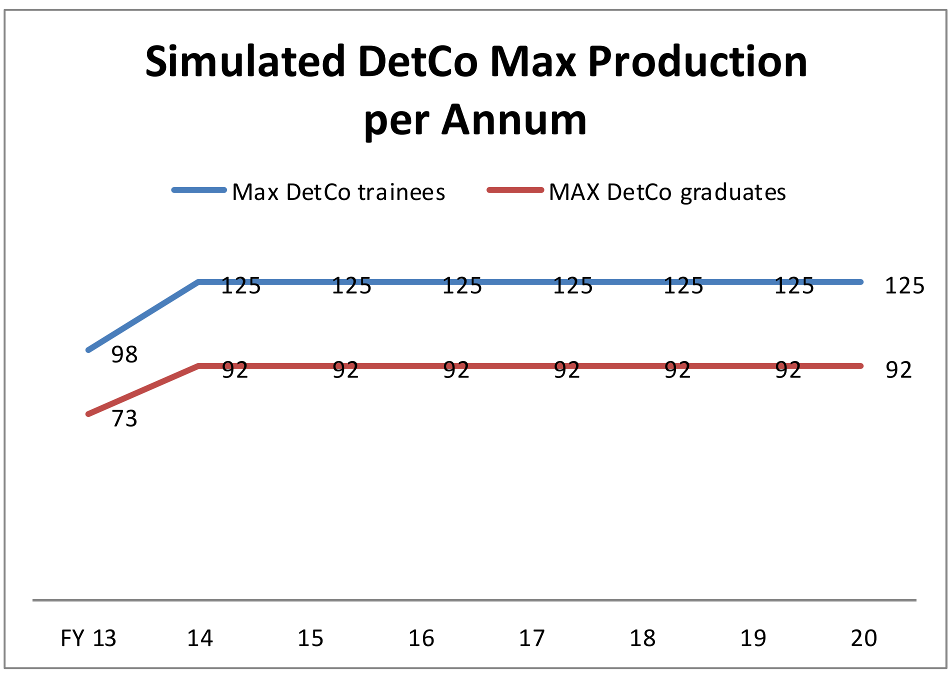
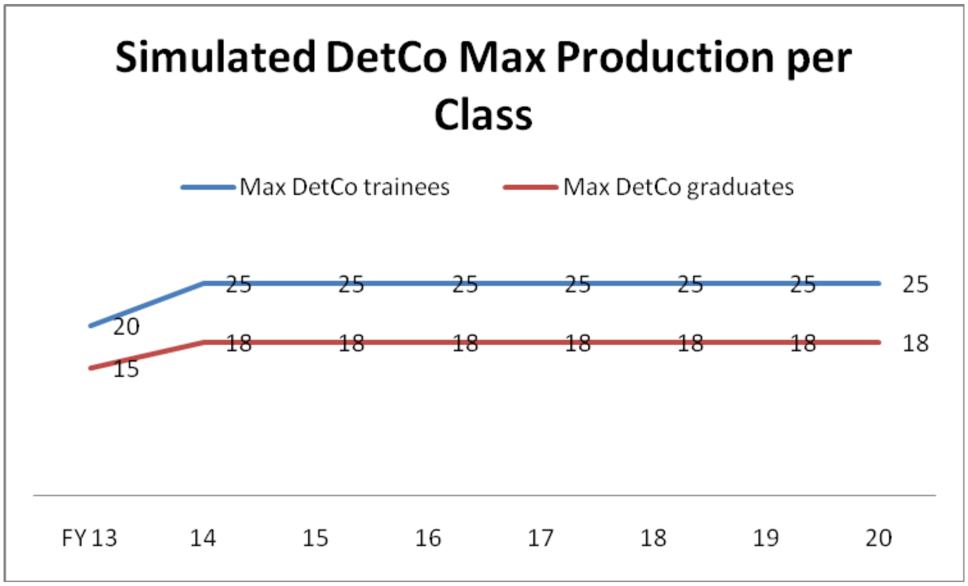
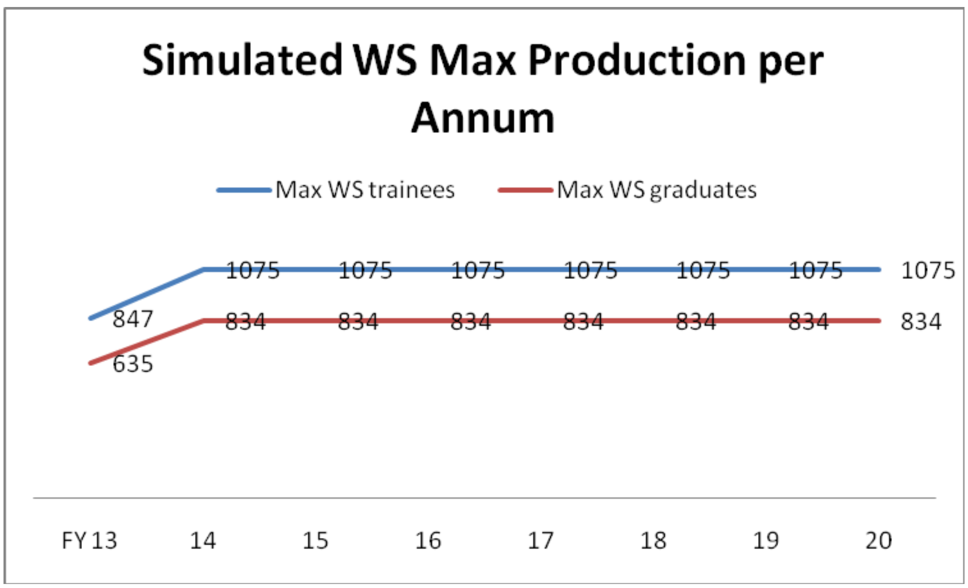
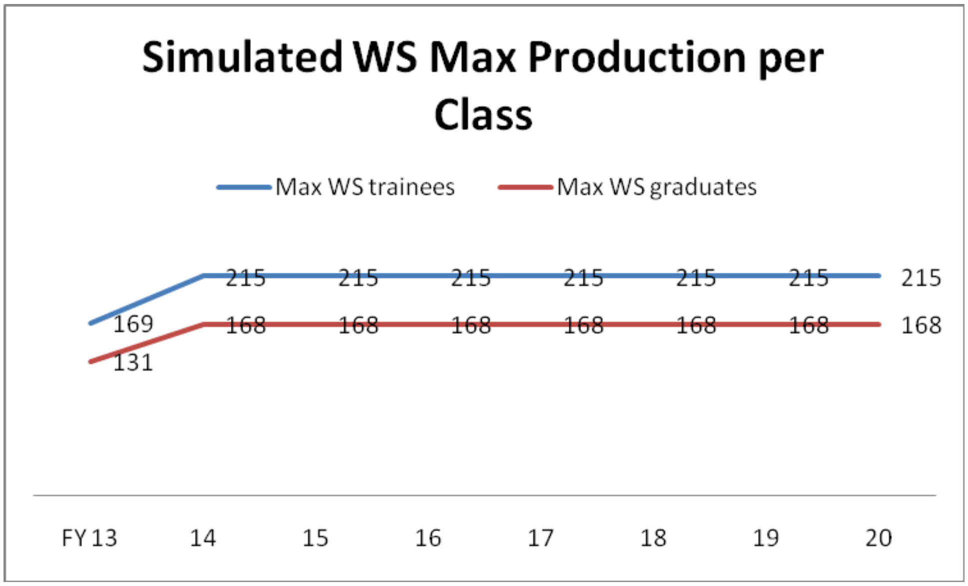
APPENDIX E: GRAPHS FOR MODEL AND SIMULATION RESULTS

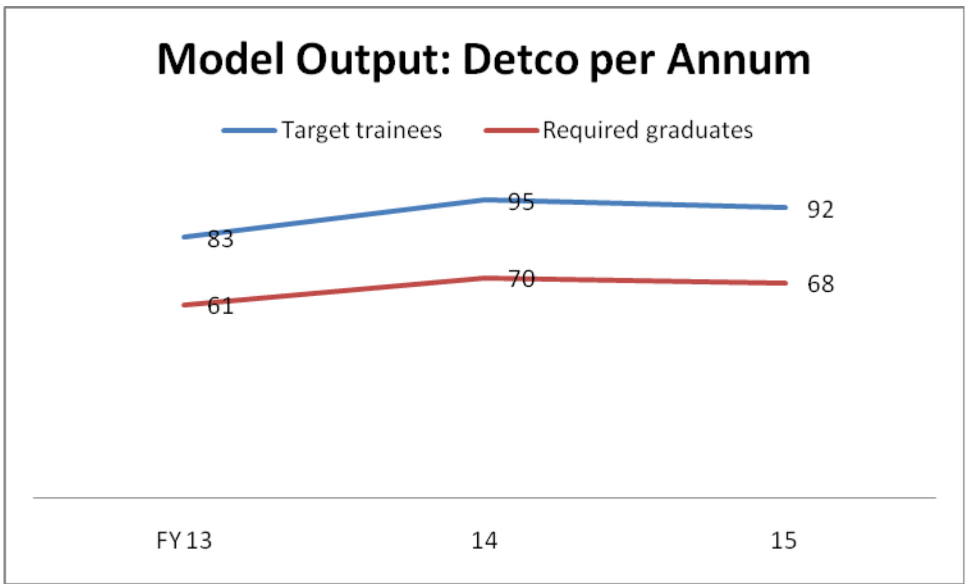


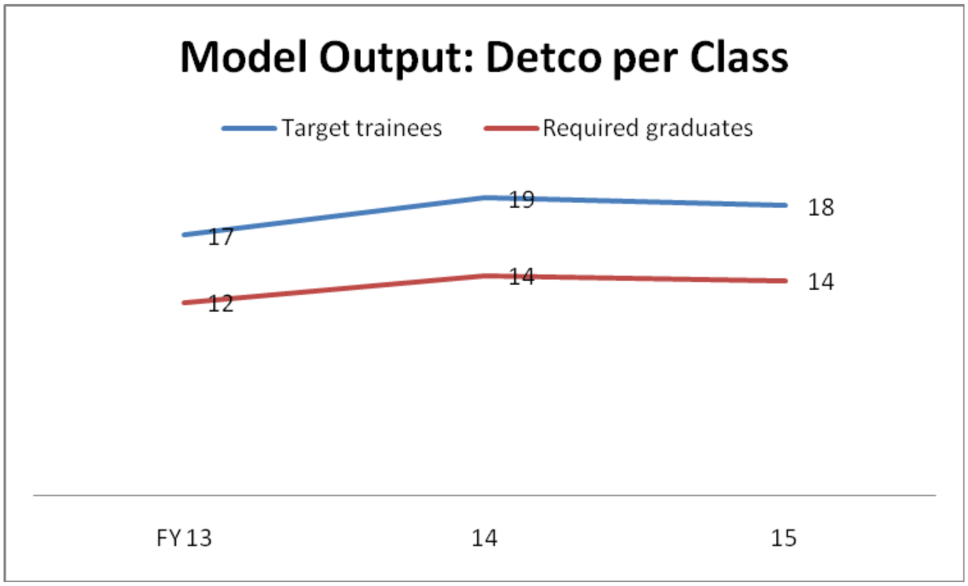


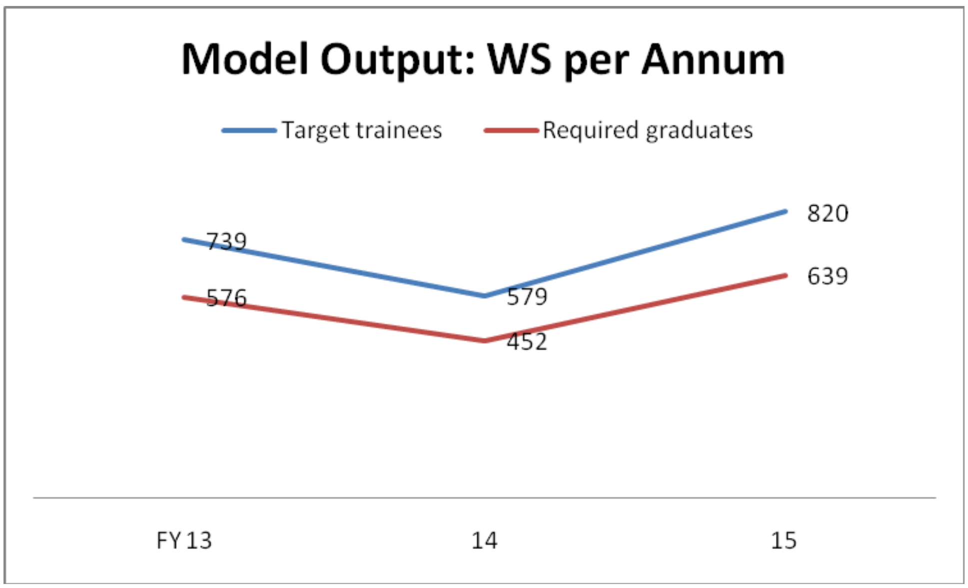

Simulated DetCo Max Production per Class
Max DetCo trainees
Max DetCo graduates
20
25
25
25
25
25
25
25
15
18
18
18
18
18
18
18
FY 13
14
15
16
17
18
19
20

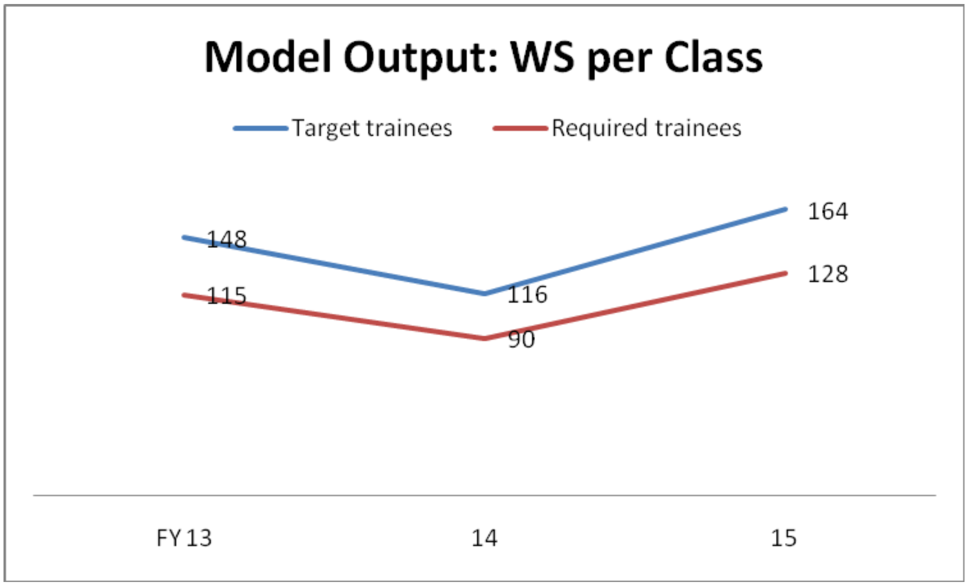

Simulated WS Max Production per Annum
Max WS trainees
Max WS graduates
847
1075
1075
1075
1075
1075
1075
1075
635
834
834
834
834
834
834
834
FY 13
14
15
16
17
18
19
20


Simulated WS Max Production per Class
Max WS trainees
Max WS graduates
169
215
215
215
215
215
215
215
131
168
168
168
168
168
168
168
FY 13
14
15
16
17
18
19
20

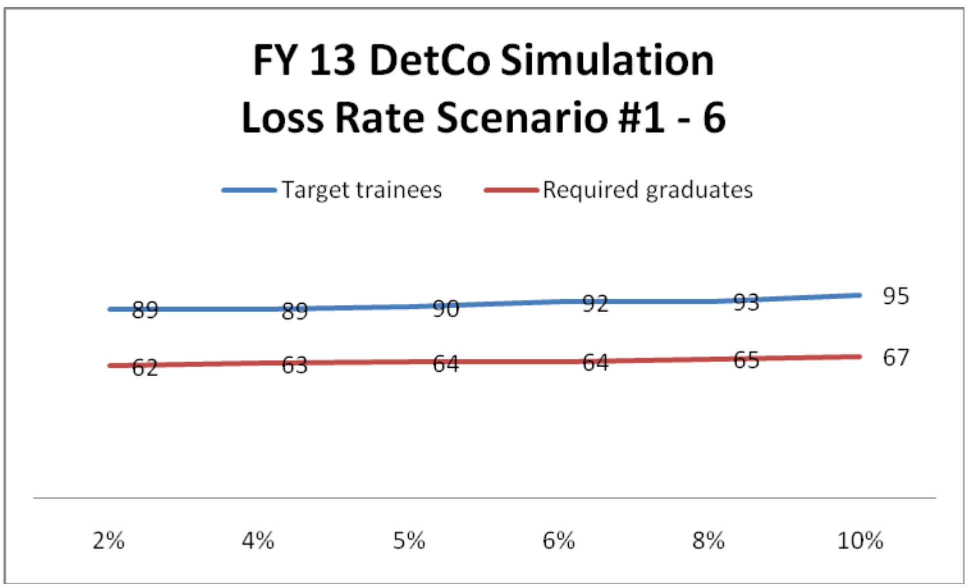

Model Output: Detco per Annum
Target trainees
Required graduates
83
95
92
61
70
68
FY 13
14
15


Model Output: Detco per Class
Target trainees
Required graduates
17
19
18
12
14
14
FY 13
14
15

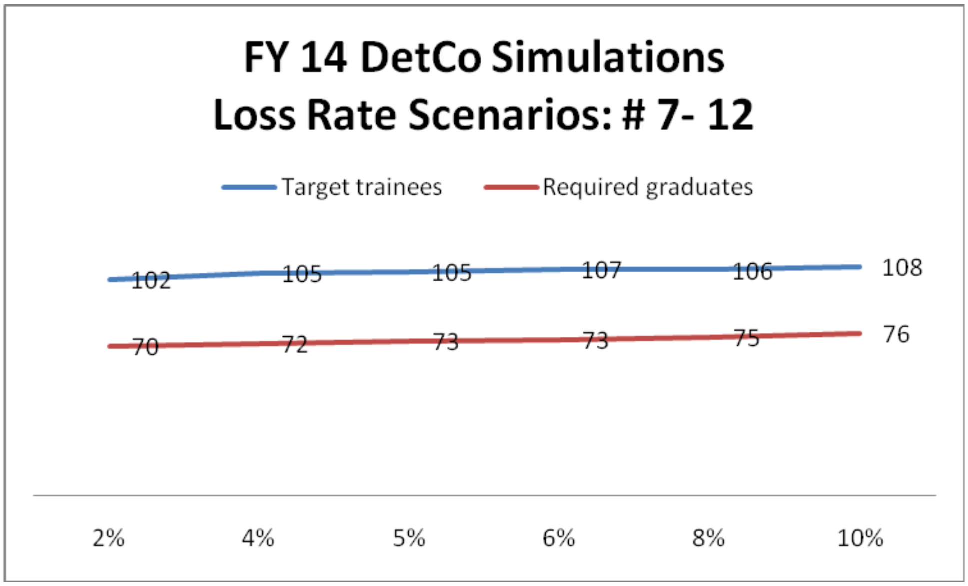

Model Output: WS per Annum
Target trainees
Required graduates
739
579
820
576
452
639
FY 13
14
15

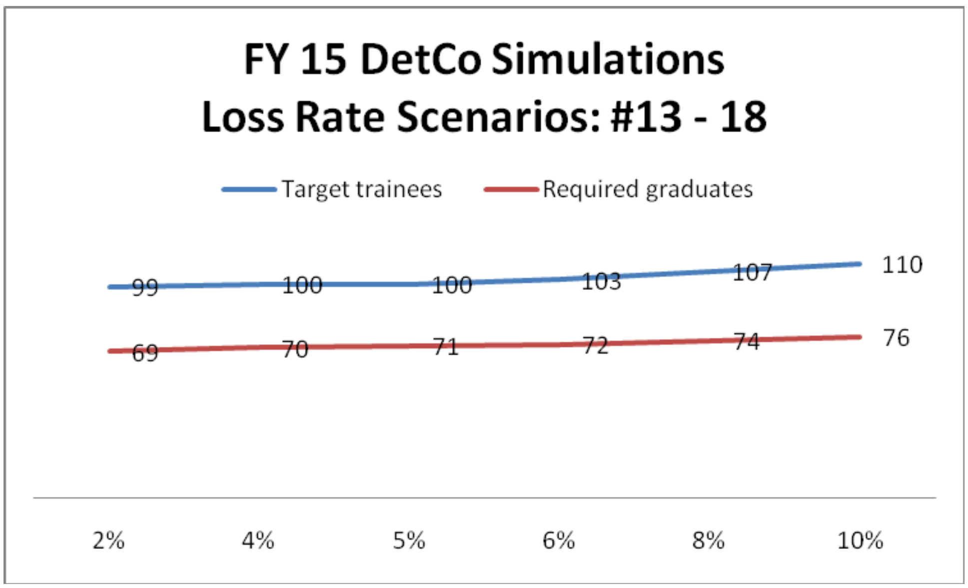


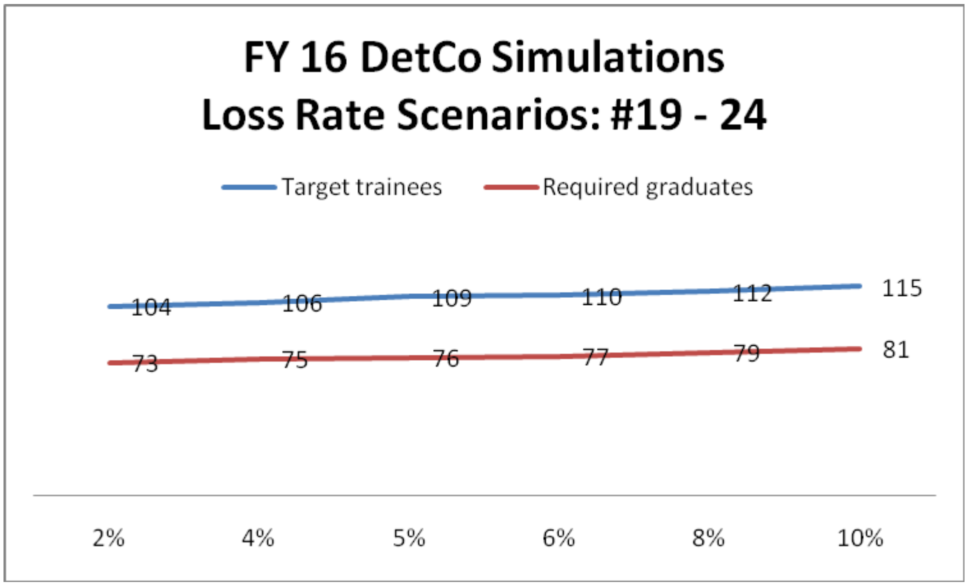
Model Output: WS per Class
Target trainees
Required trainees
148
116
164
115
90
128
FY 13
14
15

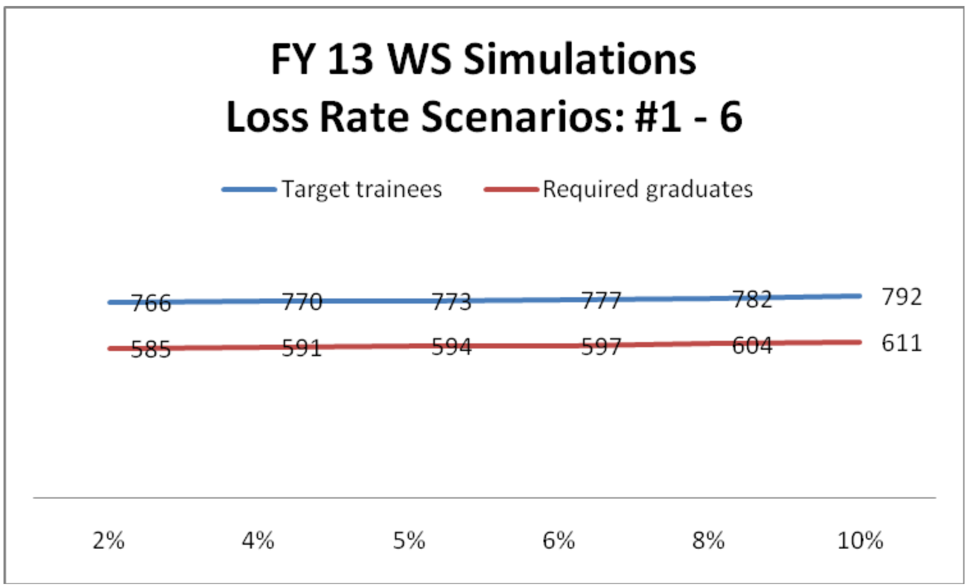


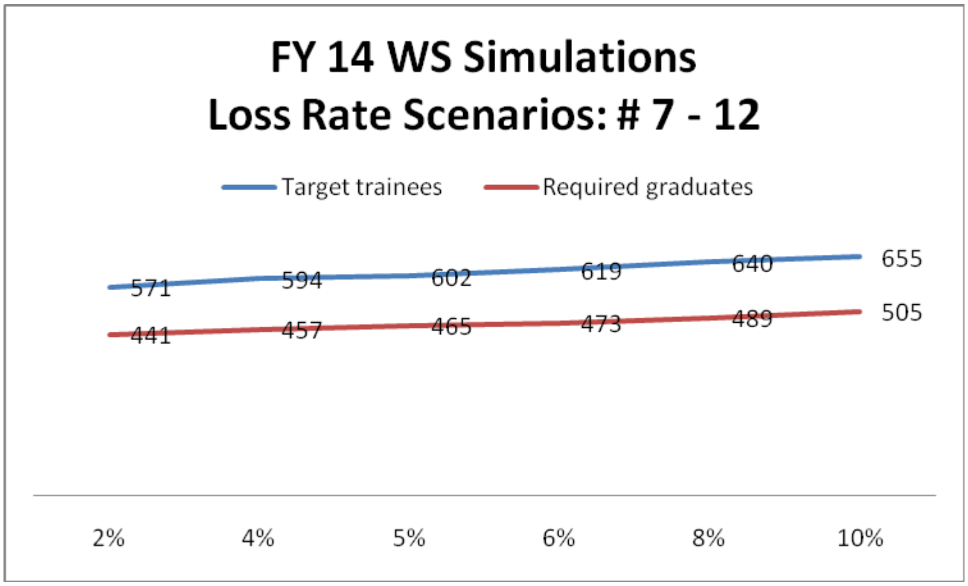
FY 13 DetCo Simulation
Loss Rate Scenario #1 - 6
Target trainees
Required graduates
89
89
90
92
93
95
62
63
64
64
65
67
2%
4%
5%
6%
8%
10%

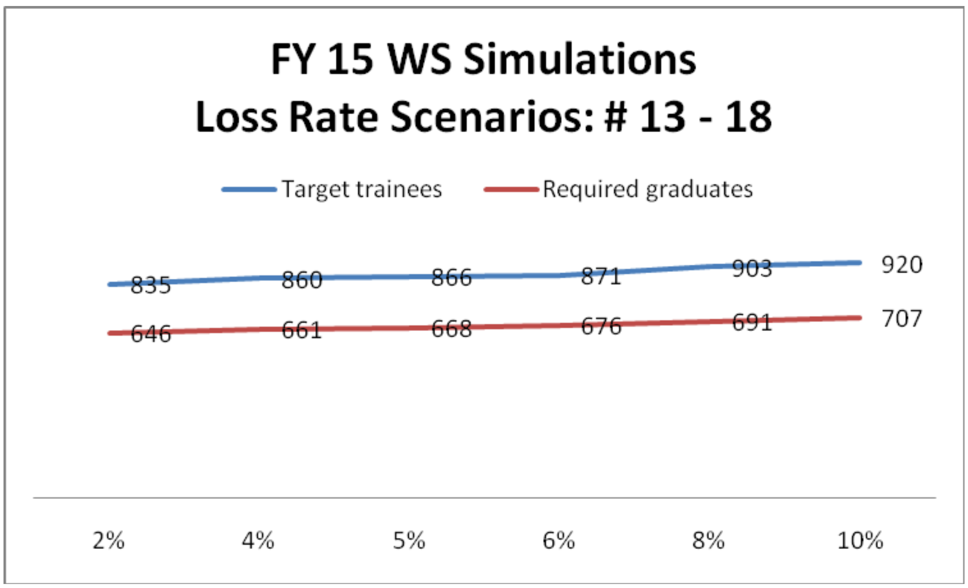

FY 14 DetCo Simulations
Loss Rate Scenarios: # 7- 12
Target trainees
Required graduates
102
105
105
107
106
108
70
72
73
73
75
76
2%
4%
5%
6%
8%
10%

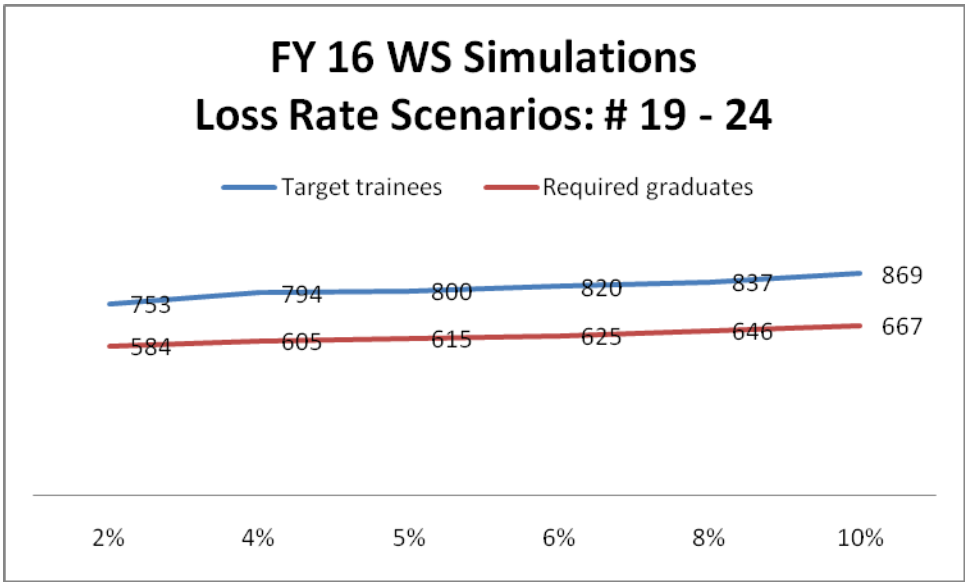

FY 15 DetCo Simulations
Loss Rate Scenarios: #13 - 18
Target trainees
Required graduates
99
100
100
103
107
110
69
70
71
72
74
76
2%
4%
5%
6%
8%
10%

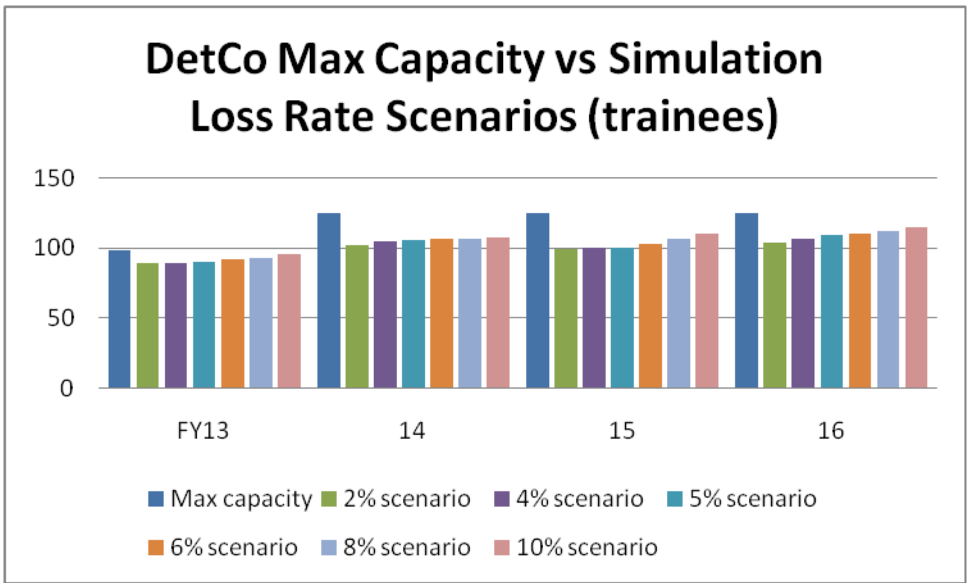

FY 16 DetCo Simulations
Loss Rate Scenarios: #19 - 24
Target trainees
Required graduates
104
106
109
110
112
115
73
75
76
77
79
81
2%
4%
5%
6%
8%
10%

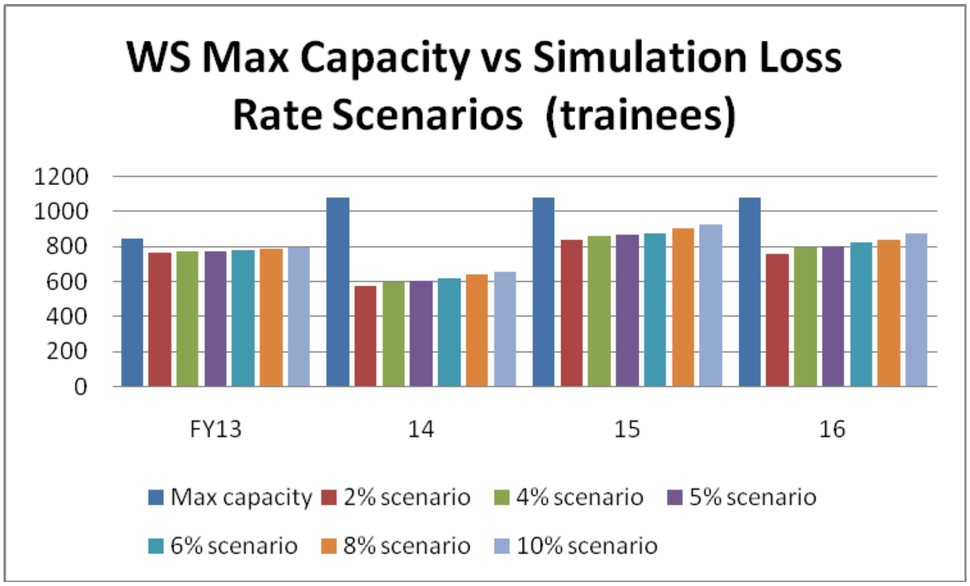

FY 13 WS Simulations
Loss Rate Scenarios: #1 - 6
Target trainees
Required graduates
766
770
773
777
782
792
585
591
594
597
604
611
2%
4%
5%
6%
8%
10%

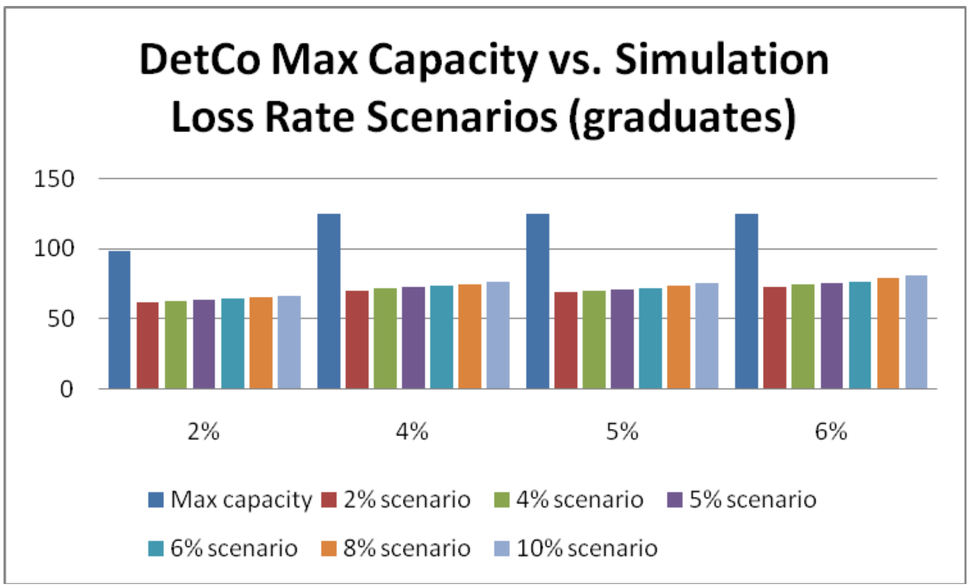

FY 14 WS Simulations
Loss Rate Scenarios: # 7 - 12
Target trainees
Required graduates
571
594
602
619
640
655
441
457
465
473
489
505
2%
4%
5%
6%
8%
10%

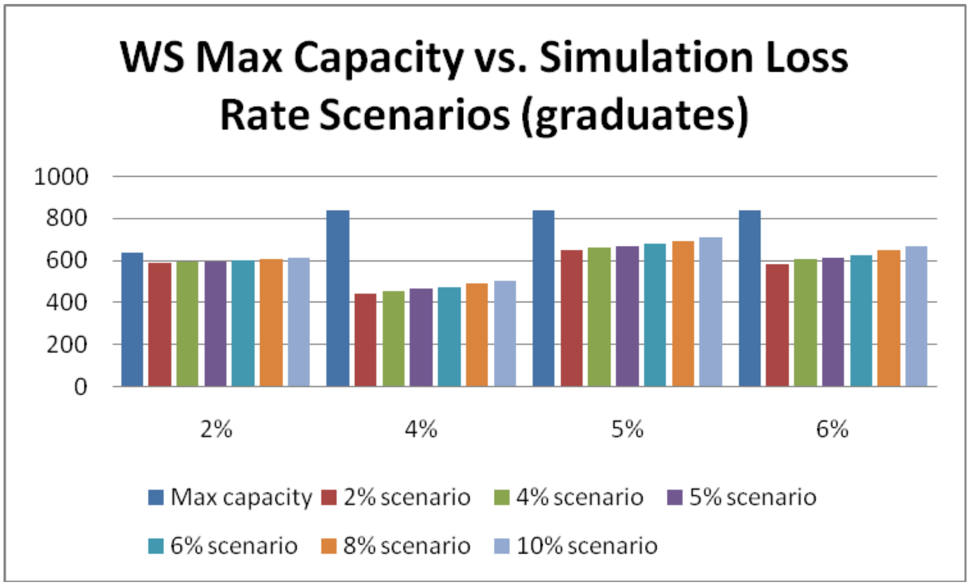

FY 15 WS Simulations
Loss Rate Scenarios: # 13 - 18
Target trainees
Required graduates
835
860
866
871
903
920
646
661
668
676
691
707
2%
4%
5%
6%
8%
10%


FY 16 WS Simulations
Loss Rate Scenarios: # 19 - 24
Target trainees
Required graduates
753
794
800
820
837
869
584
605
615
625
646
667
2%
4%
5%
6%
8%
10%


DetCo Max Capacity vs Simulation
Loss Rate Scenarios (trainees)
150
100
50
0
FY13
14
15
16
Max capacity
2% scenario
4% scenario
5% scenario
6% scenario
8% scenario
10% scenario


WS Max Capacity vs Simulation Loss Rate Scenarios (trainees)
1200
1000
800
600
400
200
0
FY13
14
15
16
Max capacity
2% scenario
4% scenario
5% scenario
6% scenario
8% scenario
10% scenario


DetCo Max Capacity vs. Simulation Loss Rate Scenarios (graduates)
150
100
50
0
2%
4%
5%
6%
Max capacity
2% scenario
4% scenario
5% scenario
6% scenario
8% scenario
10% scenario


WS Max Capacity vs. Simulation Loss Rate Scenarios (graduates)
1000
800
600
400
200
0
2%
4%
5%
6%
Max capacity
2% scenario
4% scenario
5% scenario
6% scenario
8% scenario
10% scenario

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